

June 13, 1960

# Aviation Week

*and Space Technology*

75 Cents

A McGraw-Hill Publication

SPECIAL REPORT:

RF-101C Wing  
Photo Mission

Avco Mk. IV Re-Entry  
Tracked From C-54



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For a prompt answer to your inquiry, write Electronics Division, Hydro-Aire, 2000 Winona Avenue, Burbank. A note on your letterhead brings your copy of our new Electronics Brochure.

*Qualified Electronics Engineers are invited to investigate opportunities at Hydro-Aire by contacting Mr. Harold Giesecke.*

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Latest high-temperature capacitor from  
AIRBORNE  
permits continuous  
duty at 700°F



STANDARD SIZES					
STYLE A		STYLE B		STYLE C	
PART No.	MFD	L	E	D	STYLE
TA-50	01	150	300	035	A A
TA-50	1	150	300	075	A B C
TA-50	25	250	1600	1400	A B C
TA-50	5	300	2400	2400	A B C
TA-50	10	1600	2100	2100	A B C
TA-50	20	1400	2700	2700	A B C

Designed for integration with high-temperature aircraft/missile components, this newest addition to Airborne's line of miniaturized capacitors offers a working temperature range of -65° to 700°F—without voltage derating and with low capacitance variance.

As a disclaimer for this new Airborne capacitor, we use a ribbon of film, peer review—because more extremes in characteristics at temperatures well above 700°F. The capacitor is a aluminum foil, and the completed withstand is indicated in a ribbon chart for our maximum extremes withstand. A new copper spray technique also allows us to provide high-temperature lead connections. For nominal a special ceramic is used. These and other refinements provide the characteristics listed in the column opposite.

If you have requirements in high-temperature applications, or for more information, consult Airborne. Besides our capacitor, we offer miniaturized Mylar® and Teflon® bypasses, as well as Airborne capacitors, for their electrical and mechanical reliability. Mylar is recommended to 300°F, Teflon to 400°F. Contact any of our offices or write for Product Bulletin PB-6A.

**STANDARD CHARACTERISTICS—  
AIRBORNE HIGH-TEMPERATURE HIGH  
CAPACITORS**

Dielectric strength: 44 to 4.5MF/V  
Breakdown: 200 VDC  
Die 250 to 600 VDC and  
700°F

Dielectric constant: 10.5 at 1000 Hz

Dielectric loss: 0.5% at 1000 Hz

Dielectric strength: 1000 VDC and  
700°F

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Die



# BELL "IROQUOIS" JOINS FAMED STRAC DIVISIONS\*



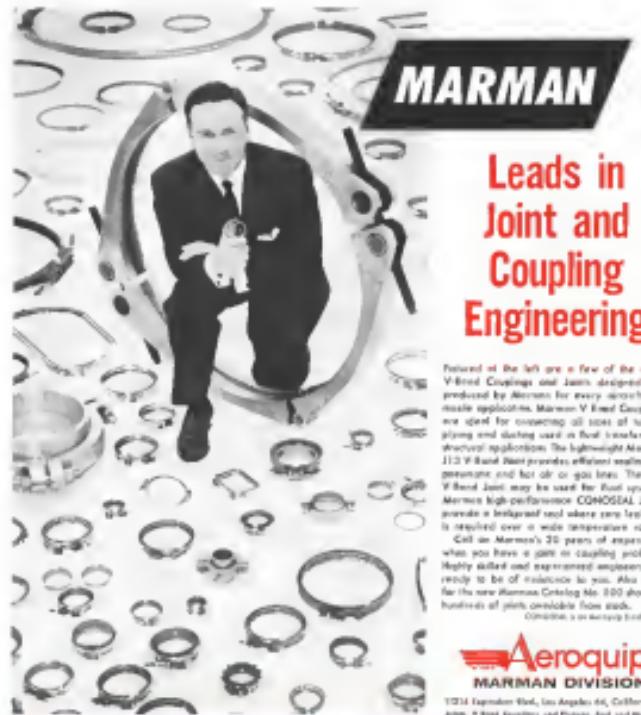
The Iroquois' "Iroquois" offensive capabilities and their fierce fire now include strafing. Recent victories over communist forces in Vietnam and Laos have received press attention (USA Today) as recently as yesterday.

## FEATURES OF BELL UH-1A PROVED IN THE FIELD BY STRAC

- **Air Transportability**—ability and movement, survivability in C-130, C-141 and C-133 aircraft.
- **Vertical Takeoff and Landing**—up to 3000 ft/min.
- **External Cargo Capacity**—up to 2000 pounds (standard cargo).

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- **Air-to-Air Gunner Control Panel**—permits commander all the job of aircraft.
- **Minimum Refueling Maintenance**—high availability, service in theater, survival in theater.

For operational turbine-powered fixed-wing aircraft, look to **BELL** HELICOPTER CORP.  
Fort Worth, Texas. Subsidiary of Bell Aerospace Corporation — its 8th year.



## Leads in Joint and Coupling Engineering

Patented at the left are a few of the many V-bread Couplings and Joints designed and produced by Marman for every aircraft and missile application. Marman V-bread Couplings are used for connecting all sizes of tubing, piping and dashes used in fuel, hydraulics and structural applications. The lightweight Marman 113 V-bread Joint provides efficient sealing for pressure and hot air or gas lines. The 211 V-bread Joint may be used for fuel systems. Marman high-performance CONOGEAL Joints provide a leak-free seal where zero leakage is required over a wide temperature range. Call us. Marman's 25 years of experience when you have a joint or coupling problem. Highly skilled and experienced engineers are ready to be of assistance to you. Write today for the new Marman Catalog. No 600 showing hundreds of joints conceivable from stock. Consider us an engineering troubleshooter.

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A WIDE PERFORMANCE RANGE IS POSSIBLE THROUGH VARIOUS FLANGE AND GASKET DESIGNS AS ILLUSTRATED



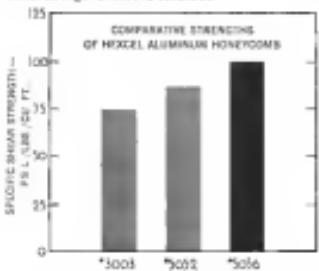
**20% More Strength...**

**20% Less Weight**

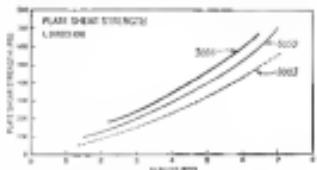
## Permit New Applications of HEXCEL Honeycomb



Hexcel meets the critical need of today's jet aircraft and missiles for stronger aluminum honeycomb with new 5056 alloy, conservatively 20% stronger than any existing aluminum core of the same weight. This important development by Hexcel not only makes possible further reduction in weight of existing honeycomb applications, but offers opportunities for a wide range of new design applications where the additional strength of 5056 is essential.



cate that 5056 has very nearly the highest strength-to-weight ratio of any aluminum honeycomb ever made, but without the corrosion problems usually associated with high-strength aluminum alloys. New 5056 honeycomb offers an immediate solution to design problems of weight and strength in the aircraft and missile fields, as well as applications in electronics, construction, lighting and packaging.



In comparison with 5052 alloy, 5056 shows an improvement in bare compressive properties of approximately 25% which is 250% of specification minimum. Shear strengths are at least 20% above 5052 and 50 to 100% above specification minimum. 5056 cell sizes are  $16^{\circ}$  to  $19^{\circ}$ ; hot gauges .001" and .002". For detailed test results and complete data see Heacock's 5056 honeycomb, with Test 46.



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World's major documents of  
American Indian art and culture.  
**Executive Editor** (1990) Paul D. Berkeley, California.  
Illustrated. Thoroughly the oldest art and culture.



**8. Tracking Spatial objects**  
coordinates and displays pertinent information for all air vehicles within the area of relevance. This EMS-Friendly tool can track several thousand moving targets simultaneously. Problem lists (million fold) are automatically flagged when a problem is detected in the operation from the system. The system automatically monitors & which tracks all activity in the system.

From the REMINGTON RAND UNIVAC

## Military Division

**TACS**—combining data processing, communications and control functions—demonstrates total systems capabilities.

A significant example of the capabilities of the Beaufort Rand Universe Military Division is the B-RUS-101 Tactical Air Control System. This USAF System is especially designed to perform surveillance, evaluation and control functions in a 300-600 square mile area, repositioning the fire situation every 30 seconds to facilitate command decisions.

The transportability of the System allows Control and Reporting Centers to be quickly moved into forward positions to give surveillance of tactical territory. A communications network, involving both voice and digital techniques, coordinates these functions with weapon groups and other military activities to successfully meet the fast-changing needs of the tactical air situation.

Designed and built by the Military Division, the Tachyon Air Control System fully integrates the compartment, communication and control functions. The System represents a solution to a complex problem and exhibits the characteristics which have become identified with Remington.

Road Ultron achievements in the military area—compact size, high speed of operation and reliability under demanding environmental conditions.



**The Central Function** results in management of reward in which rewards by the central office, involving negotiating in targets and rewards in a general target, are linked to firm measures and incentives for managing overall firms. The resulting rewards are highly predictable and based on targets, and policy is encouraged to be based on a broader and more lasting basis than management and staff. As an overall target, rewards are set in advance, providing a highly integrated and consistent reward system.



Orion: non-visual and ultraviolet sensors developed by the Bremerton-Ford Space & Info. Div. of Boeing Inc.  
**ATHENA**, the Einstein Ultraviolet Imaging Experiment for the UTP - Air Force  
1982-1985  
**SOHO** (Solar and Heliospheric Observatory) for the U.S. and Europe (1995-1998).

**SEA SURVEILLANCE SYSTEM FOR THE U. S. NAVY**  
**AN/SSB-10 (Advanced Computer for the U. S. Navy).**  
Additional information concerning availability and performance of  
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ESCAPE SLIDE

another product of Air Cruisers research



#### NEW ESCAPE SLIDE SAFETY FEATURE

This flexible escape slide developed by Air Cruisers for jetliners provides a safer emergency evacuation of passenger aircraft, particularly at extreme aircraft attitudes.

The passenger's speed of descent is automatically reduced by his own body weight bending the last portion of the flexible slide closer and closer to a horizontal attitude as he nears the ground. Rate of descent is safely stopped as the passenger eases off the final

feet of slide resting parallel on the ground. Simple to operate, Air Cruisers escape slides are standard equipment on many turboprop-powered military and commercial aircraft.

The Air Cruisers jet pump, which produces rapid inflation vital to the fast, dependable operation of escape slides, is yet another contribution toward better survival equipment by America's most experienced fabricator of inflatables from rubberized nylon materials.

Your inquiries are invited!



AIR CRUISERS DIVISION

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If profitable arc-welding is important to you, then you ought to investigate the complete line of modern Harnischfeger equipment. For example, P&H weld-programming with motorized rheostat or sequence-timers enables you to weld Space Age and other super-critical metal automatically! Or you can automate your welding with P&H punched-tape control. Both are infinitely versatile and standardize weld quality at levels

impossible with manual controls. P&H also offers you industry's most complete line of industrial welders — 1 to 750 amps. — AC, DC, or dual AC/DC machines with h-f, spot gun, and gas and water controls. And P&H engine-driven welders give you compact, self-contained 25- to 500-amp. weld-power for field jobs. The different types of P&H electrodes enable you to match the analysis and properties of many weldable parent metals. And you can cut welding labor and overhead costs in half with P&H welding positioners. So...

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WELDERS • ELECTRODES • POSITIONERS  
MILWAUKEE 48, WISCONSIN



## A3J—the most versatile Mach 2 airplane in the world today

Prizing the horrors of the Free World, hovering on the fringes of tension areas, belittling the cause of world peace by its omnipresence in the sky—this is the job for the Navy's new A3 Vigilante.

Designed and built by the Columbus Division of North American Aviation, the A3 has a versatility unmatched by any other Mach 2 airplane in the skies today. It is equipped to handle a variety of nuclear or conventional weapons for either limited or all-out nuclear war. It has the speed and maneuverability to fly single plane attack missions without fighter escort.

The Vigilante can fly through the stratosphere faster than the earth turns beneath it; it can throat-dive to conformable landing speeds for carrier decks—or small fields ashore. It is also notable for prompt response due to systems that make it ideally suited for low-level missions over irregular terrain. Its speed and maneuverability plus the most advanced fire control systems known make it a single airplane with an outstanding dual capability—high performance attack or long-range interception.

The A3 Vigilante truly is a significant addition to the U.S. arsenal dedicated to preserving world peace.

THE COLUMBUS DIVISION OF NORTH AMERICAN AVIATION, INC.

Columbus, Ohio



FOR THE AIR FORCE, MSWD developed experimental 12-foot and 18-foot ACRS recovery vehicles, the RVX-2, larger versions of the Recovery Vehicle, with an auxiliary payload system, also developed for General Electric by Clark Research Laboratories, is shown being lowered on board ship.



...center for missile and space technology research and development at General Electric

## Progress in search and recovery

With each recovery of a space vehicle, scientists gain important new knowledge about the environment of space and its potential effect on man and the operation of vehicles and equipment. As advanced vehicles are developed for space flight—ones with life aboard—successful location and recovery become increasingly vital.

General Electric's Missile and Space Vehicle Department pioneered in the development of space vehicle search and recovery techniques as part of its re-entry and recovery vehicle program for the U.S. Air Force. MSWD developed and built the first payload to be recovered from space—an 18-inch data capsule ejected from an Air Force Thor re-entry vehicle on June 25, 1958. Many such data capsules have since been recovered from both Thor and Atlas flights. Some carried cameras providing films from space. MSWD also developed and built the 12-foot long, man-tow recovery vehicle shown above which the Air Force recovered on July 25, 1959—the

first to be returned to earth. Today, as MSWD builds and flight tests more complex vehicles, it is continually expanding and improving its already successful search and recovery program.

Currently, this search and recovery experience is being applied to the development of such important space programs as the Air Force "Discoverer" recovery satellite and NASA's radiation research research satellite (NRW).

For more information about MSWD's work in search and recovery, write to Section 580-72, General Electric Co., Missile and Space Vehicle Department, Philadelphia 4, Pennsylvania.

**GENERAL ELECTRIC**

MISSILE AND SPACE VEHICLE DEPARTMENT  
A Department of the Defense Electronics Division

Scientists and Engineers interested in career opportunities in Space Technology, contact Mr. E. H. Schlegel, Dept. 142, MSWD.



## NEW MICRO-DIFFERENTIAL PRESSURE METER



A NEW INSTRUMENT BASED ON THE PATENTED DECKER TIDIONIZATION TRANSDUCER

Now you can measure differential pressure from -0.0001" HgD to  $\pm 100$  HgD with a single sensitive and ergonomic pressure meter. Differential pressure can be read directly from the new Decker Model 306-2 Meter, or the 10 Vdc full scale analog output can be fed to external displays, recorders, or control devices.

The entire range of pressure is covered with just a single interchangeable Series 306 Sensors. Each contains

a precision, corrosion-proof two chamber capsule. Any diaphragm motion is sensed by a capacitance pickup that exerts negligible adverse force on the diaphragm. Measured capacitance changes are converted by the T-62<sup>®</sup> Isolation Transducer to large analog output voltages indicating direction as well as magnitude. The instrument is capable of 0.01% resolution.

Complete details on the meter are in Data Sheet 306-2. The Sensors are covered in Data Sheet Series 306. Write The Decker Corporation, Bala Cynwyd, Pennsylvania.



## The challenge of silence

The wide and deep sea is a near-perfect hiding place... and an infamously mobile missile launching pad. The modern submarine poses a high-priority defense problem.

Not just the sea, but the surface and the air as well comprise the theater of ASW. And in all these areas, Sperry is making advanced contributions: submarine sonar detection gear, submarine fire control systems, submarine depth and maneuvering controls... countermeasures and counter-countermeasures... sophisticated navigation computers for helicopters, capable of programming a hydrostatically precise sub search... automatic flight controls for the helicopter to

sonar complexity... for surface ships, precision torpedoes for control and hydrofoil stabilization and control systems.

Most of today's ASW programs utilize sound radiation techniques. But long, complex and myriad "sonar" techniques of sonar-hunting, yield new frontier for scientist and engineer.

Recognition in the electro-magnetic spectrum... development of advanced transducers, data processing, and means of displaying data that is gathered.

These anti-submarine warfare programs, ranging through the three dimensions of our environment, typify the integrated capability of the Sperry organization today. General offices, Great Neck, N. Y.

THE DECKER CORPORATION Bala Cynwyd, Pennsylvania

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## THOR DETERS AGGRESSION

Now rolling from assembly lines in the U.S. A. and being deployed by our ally, Great Britain, is the aggression-deterring, nuclear-armed THOR missile. Exceptional reliability has been achieved in this IRBM missile through simplicity of design and dependability of components.

Vickers pumps were selected for the vital hydraulic system on the THOR because of their proven reliability record, based upon millions of flight hours in military and commercial aircraft. Vickers built components or complete auxiliary power systems are aboard nearly every missile built in America.

For the future, Vickers is working side by side with contractors, such as Douglas, on new and revolutionary APU concepts for missiles and spaceflight of the next generation.

Your nearby Application Engineer can "tell you in" on the latest and most promising of these Vickers developments. Write for Bulletin A-5233A.



Vickers Main System Hydraulic Pump being installed on THOR



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June 13, 1969

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The Navy's Polaris will use

## 3/4 OF THE GLOBE FOR A LAUNCH PAD

A solid-propellant missile that will be launched from open depths. A nuclear-powered submarine that will cruise for months without surfacing. The Navy has combined them in the Fleet Ballistic Missile system. Each nuclear warhead will be a mobile missile-tube, capable of penetrating 70% of the earth's surface, ready to launch 16 Polaris missiles in as many minutes. Argent General furnishes the guidance for the Polaris missile. General Electric's guidance. Lockheed a prime contractor and systems manager.

**LOCKHEED**

植物的生长发育由光周期长短调节的植物称为光周期植物。



Second stage of Polaris test vehicle, which has instrumented container on its nose, separates and ignites after first stage has landed at 1000' apogee.

## EDITORIAL

## Two Positive Programs

There are two new aircraft development programs looming on the horizon that need some extraordinary effort from the aerospace industry and the executive and legislative agencies of the government if they are to achieve any significant success in adding to our national strength. These programs will be dependent on the technical resources of the aerospace industry and, at least in our programs dependent on new and more effective utilization of these total resources. They will also set up some new working relationships between the Air Force and the Federal Aviation Agency, as well as possibly require legislative and funding support from the Congress.

Both of these programs may be attacked on the grounds that they will serve only the special interests of the aerospace manufacturing and transport industries. But we doubt if these arguments will long survive the glare of full public scrutiny. Actually both programs offer the opportunity for substantial additional dividends on our total federal investment and can produce major improvements in our civilian economy and our military posture. These concerns are:

Development of a multi-cellular, multi-powered, cargo plane. This is an option for both civilian and military requirements. The critical needs of MATS for a multi-cellular jet cargo plane to replace its aging fleet of C-134 piston-powered transports which does not have air logistics to a Panhandle's pace in a short time have been well defined and substantiated. It also is evident that the military's eight-pilot, the crew salaries and the national economy would benefit greatly from a joint development program to meet these requirements.

It is true that at present efforts to develop aircraft to serve both military and civil purposes have lagged down in the race of specialized military requirements, details and implementation on the rugged rods, while the tasks of the airlines, who feel that a colored colored citizen interior is a basic policy matter. However, we are reaching the point where some of the highly congested airports, both of the airlines and some of the military, details, which must be accommodated in the last purpose of producing a new type aircraft that will do the military, which can be accommodated by a different, as a result, of the development of the aircraft.

We are not speaking now of the specialized craft for overland military cargo such as the C-135 fleet designed to carry C-IVBAs, but of the intermediate class of cargo transports designed to carry all but the special outsize military cargo. This requirement has been amorphously defined in a USAF strategic operational requirement, some companies have done considerable preliminary design work toward it, FAA and USAF have concentrated as far as much toward it, and Congress appears ready to approve a \$55 million increment in the Fiscal 1964 budget to start the development bill rolling.

This is a truly worthwhile project from the overall national interest. It will help plug a generally admitted critical gap in military orbit capacity. It will also lift the civil air cause because of its modest plateau and

offer it an opportunity to make a major contribution to a more efficient national economy through adding a major speed increase to the distribution system. It will provide an opportunity to develop a large military strategic capacity at any low cost through the operation of a profitable oil fleet of these aircraft which will be available in the tremendous transport task that would result from either another heated war such as Korea or a full scale nuclear conflict.

The technical state of the art is well able to handle this development problem immediately. The problem is executive decision, administrative coordination between all of the groups directly concerned and some vital leadership that will provide sustained drive and maintain a

Development of a supersonic transport. The national benefits from this project are less tangible than those from the jet cargo plane, but they are substantial. The universally recognized world leadership of this country in aerospace from the days of the DC 3 to the subsonic jet Intercontinental has not yet had a substantial successor, and tangible evidence of international prestige. The supersonic (and by the same Math 2 in flying) transport will represent another major symbolic form of compensation in man's long effort to share the globe he inhabits. The nation that leads in this effort will gain significant international recognition, along with the passing sense of boosted morale, prestige,

This program is of a technical and financial magnitude beyond the capability of any private industrial complex or any single government agency. An effective organization of all national resources available in this area must be achieved and focused on this goal for any real prospect of success.

"Federal Aviation Agency has been effective in keeping the National Aeronautics and Space Administration's research and research facilities active on the problems (AWM Mar 2, p. 60). Many individual organizations have had their programs explaining the possibilities beyond Stack 2. Under the jet cargo plane, the aerospace transport still poses many unanswered questions and has a state-of-the-art gaps in the broad technical spectrum its problems cover."

Although it may well be premature to attempt the actual construction of a Mach 2.5 transport aircraft at early operational airline use, it is certainly high time that a national effort be organized aimed at achieving this goal. The necessary research and developmental gaps should be defined and then filled, and responsibility for the implementation of the program should be established.

The leadership of this program should be assigned. It will be a sad day indeed at this country rate should we be in the minimization race to produce a sound, economical operational aerospace transport.

—Robert Hays

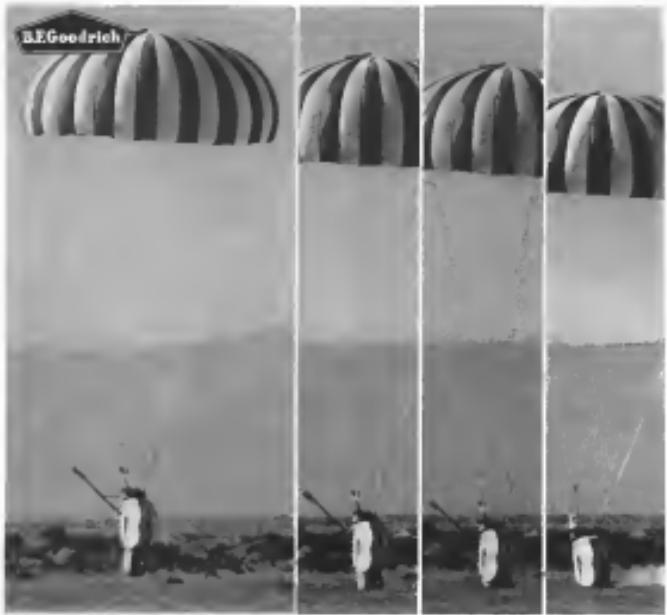


Photo sequence shows initial stages of test of B-72 ejection capsule. In last photo test director views at night of capsule in air made through "Mensor" tube.

## Engineered "blowout" cushions landing

When the B-72 ejection capsule hits the ground, the inflated rubber bag in the horizontal shock initial impact—then the bag retracts through a "blowout" valve just at the point of maximum compression to eliminate any remaining "bounce" action. The bag must park in mid-air space, move intact within 5 seconds.

B.F. Goodrich is equipped to engineer and build shock attenuator systems that meet demanding requirements like this. The systems are complete—incorporating the flexible bag, valve and inflation device. Special BFG test facilities aid in patterning the right system to meet the specific requirements of load, approach speed, and tolerable G limits.

If you have a requirement for an engineered shock attenuator system, check with B.F. Goodrich Aviation Products, a division of The B.F. Goodrich Company, Department AW 48, Akron, Ohio.

### Use B.F. Goodrich shock attenuator systems on your advanced projects



## B.F. Goodrich aviation products

## WHO'S WHERE

### In the Front Office

**B. F. Coggs**, vice president-special projects, General Dynamics Corp., New York, N. Y. Robert C. Loomis succeeds Mr. Coggs as vice president and San Diego division manager.

**M. David Ford**, board chairman and chief executive officer, Northstar Eng. serving Inc., Manchester, N. H., now expand division of Atlantic Research Corp.

**Widnes, Ltd.**, the English Electric Co. Ltd. and the British Aerospace Co. Ltd. have formed British Aircraft Corp., Ltd. to bring together their aircraft and guided weapon interests. Director of the new company, the Member of the Royal Air Force Vassaret Peppiatt of Hawarden, North Wales, is chairman. S. J. Thorpe (aerospace chairman), George Nelson (aerospace), Sir George R. Edwards (aviation director), William Martyn (space and director), G. A. Balldell and R. F. H. Tregear.

**Werner G. Bahnsch**, president Comsat Corp., Centex Co., Dallas, N. H.

**Robert J. Currie**, vice president of Wyle Laboratories, 122 Seward Avenue, has been appointed general manager.

**John C. Coughlin**, president and chief executive officer, Standard Research Corp., Santa Ana, Calif., has elected the following vice presidents: Martin J. Kuhn—marketing; Raymond W. Wallis—engineering; Irvin R. Karpowitz—operations.

**Edward B. Dell**, vice president of Space Technology Laboratories, Inc., El Segundo, Calif., has been appointed director of the company's Satellite Engineering Division.

**Long Electronics Division** of Long Vite Electronics Inc., Vicksburg, Calif., has appointed the following vice presidents: Robert F. Martin—management; Charles Thorburn—marketing; Vice Edward F. Klein, manager of systems engineering; Thomas A. Schaeffer, manager of Prod. 3 Division, and controller.

**V. F. Hart**, vice president and general manager, San Diego S. Engineering Co., San Diego.

**Henry E. Houser**, vice president, Defense and Civil Control, Calif., has appointed Carlton D. Smith and vice president, Washington D. C. Radio Corp. of America. Olaus S. Olfert, director of engineering and customer relations at Roush Electronics Division, entered a vice presidency of Roush Electronics Co. Inc., Long Beach, Calif.

**H. L. Johnson**, vice president and general manager at the Tucson Cold Electronics Facility, R. L. Clark, vice president and manager, San Diego.

**Ed. Victor J. Young**, vice president, Belfort Electronics Division of Belfort Corp., Los Angeles, Calif., has appointed **Walter E. Rausch**, former senior vice president-engineering, for Douglas Aircraft Co. Belfort Electronics has joined the staff of the Rockwell Space Division, Calif., as a special consultant.

(Continued on page 127)

## INDUSTRY OBSERVER

► Configuration changes in the USAF Douglas Skystreak interceptor missile (AW June 6, p. 219) are greatly increased original cost estimates for research and development phases. Team from Wright Air Development Division currently is being given a complete cost analysis bearing on the missile system by Douglas management engineers.

► Universal test set to be developed for Douglas Skystreak by Belfort will use an adapter so that it may be compatible with Skystreak, North America's Honest Dog and possibly other missiles in the air-launched inventory. One function of this piece of ground support equipment will be to automatically check out all operating components while missiles are still in customers' storage. Total of approximately 55 sets is now planned.

► Rocketdyne F-1 single-chamber, 1.5-million lb. thrust rocket engine will operate at a chamber pressure well over 900 ps. This is 10 to 20% higher than the chamber pressure in Rocketdyne's engine in the Thor, Atlas and Saturn vehicles, and it will give the F-1 engine a higher specific impulse and prevent the use of a shorter combustion chamber. Higher precision in the F-1 were made possible through more efficient tooling design for regressive tooling and improvements in materials and fabrication methods.

► Licensing Division of Avco Corp. expects certification of its T53 turbine engine this month. Production has begun on the 900 shp. T53-L5 turboshaft engine, which recently passed MILSPEC qualification tests and will power the Bell UH-1B. Both the L5, being flown in the Grumman Mohawk and the L5 are now completely interchangeable except for the gauging. Licensing also has secured a development contract for its L7 turboprop version and L9 helicopter version, which it expects to power the HUH-1D. Both are rated at 1,000 shp. The company plans to develop the T53 up to 2,000 shp.

► Development of the inertial system for the USAF General Electric derivative nuclear rocket engine now is being done by GE in its own facilities instead of by Marquardt Corp. Low funding level of the program is behind GE's withdrawal of the subcontract.

► First missiles of the USAF-Martin Titan I series are at Cape Canaveral, Fla., and first flight is expected within approximately six weeks. Titan I, which will be fired in soon as the current G series is finished, is quite similar to the G but is the operational prototype. Missiles to be fired from Vandenberg AFB will carry a V designation, or VS if they are to be launched from a silo. Those located at other field sites will be designated only.

► First launching of a USAF-Martin Titan from Vandenberg AFB now is expected during October. Both the J series to be fired from Vandenberg AFB, the V series to be fired from Vandenberg will carry a small amount of instrumentation to help determine performance, aerodynamics, etc. Sheath after the first flight from Vandenberg, the first site launching from the same base will be strengthened. Site elevator and other systems are being checked out now with a ground satellite, designated MI, which is a test item from the B lot converted to carry the subsystem of an operational missile.

► Fighter jet branch at Air Research and Development Command's Wright Air Development Division has been reduced to 14 aircraft and 14 pilot seats from a former strength of about 100 pilots and 10 aircraft, which handled more than 100 active projects.

► Next likely step in consolidating USAF flight test personnel and equipment is move of Wright Air Development Division's all-weather flight test from Wright-Patterson AFB, Ohio, to the Flight Test Center at Edwards AFB, Calif. Reasons are expansion in the Dayton, Ohio area, closer location of Edwards to cold-weather test sites in Alaska, and better weather testing aspects and general safety in the Edwards area.

# LIBRASCOPE COMPUTER FACILITIES

**LIBRASCOPE COMPUTER FACILITIES** Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense... others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy: A decentralized organization of specialized project teams responsible for assignments from concept to delivery... and backed up by excellent research, service, and facilities. For your computer requirements, call on the company of diversification in computer technology is unsurpassed. Division, General Precision, Inc., 808 Western Avenue. For career opportunities write to John Schmidt, Engineering



production facil-  
whose breadth  
■ Librascope  
Glendale, Calif.  
employment. ■

computers that pace man's expanding mind.



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## Washington Roundup -

### Rockefeller's Challenge

Person for debate of defense and other defense issues devolved on the Senate a side last week. New York Governor Nelson Rockefeller sealed the path in demanding the visit of Vice President Richard Nixon and presenting an appropriate platform of his own.

Rodolfelli wants to spend an extra \$5 billion for missile defense needs. He thinks U.S. ICBMs are too few and too vulnerable to attack. He wants an airborne alert to protect the SAC bomber force, and he wants two bombers developed. More long-range bombers and ground-based modernization are also on his list.

Tighter organization of the Defense Department is on the Radcliffe platform as a more flexible, better balanced defense establishment and philosophy, one which could be ready for all emergencies, including land wars.

Rosenthal said handling of the U-2 incident is evidence of a need for better government organization to meet internal and international problems. Sen. Harry

U.S. sources in the assessment condition was issued another sheet of instructions also got into the U-2 controversy last week with his whereabouts on nations' behalfs unknown. Secretary of State Christian Herter has scheduled at the first written, in his followed by Defense Secy. Gen. Thomas Gates.

U.S. opposition to the settlement process has raised serious fears of a general nuclear war. Beckwith called for a more vigorous approach. His overall task of preparation for disarmament conferences and the U.S. needs to meet crises as they occur.

First hope for a disarmament agreement has survived the session and Soviet Union has proposed a plan and the U.S. has promised to give it careful consideration. The Geneva disarmament meeting which followed the talks, Soviet negotiators indicated a willingness to continue serious negotiations but Western negotiators are wary of promises calling for total elimination of nuclear weapons within a strict and uncertain time.

Big Gun Homer A. Throster, who headed USAP's first space office at the headquarters level, is being assigned to head ARDC's Arnold Engineering Development Center. He will be replaced in Big Gun Richard Crathen who has been broadening our activities for Ballistic Missile Division.

Carrie will serve two bats as the result of a recent reorganization. He will have another's old job as assistant for advanced technology, to Deputy Chief of Staff for Development Lt. Gen. Rocco C. Wilson, and he will be deputy director of the new Systems Development Directorate which is headed by Maj. Gen. Michael C. Denkla.

Maj. Gen. Victoria R. Hargan has moved from director of development planning to assistant deputy chief of staff, Wilson, replacing Maj. Gen. Leighton J. Dunn, now head of Air Force Misfit Test Center. Hargan is replaced in Big Gen. W. B. Kimball's planning job, and Big Gen. Ralph L. Wissell is heading the new Directorate of Research and Technology.

Defense Department is visiting the idea of centralized management of electronic equipment and material prepared by General Accounting Office. GAO estimates that centralized management could save more than \$25 million a year in administrative costs and through elimination of duplication.

### AFMTC Independence

Wards for Air Force Music Test Centers to stay essentially independent of Bell-Nunnally Districts as the ARDC organization persists. This is a reversal of earlier plans to put the center under BMD in line with the pattern of placing all centers under one of ARDC's four new districts.

Four major ARDC divisions will function primarily as Headquarters divisions under and report directly to the Director:

**BMD** complement at Cape Canaveral will be strengthened, and AFMPC will be at the present level of **involvement**. This stems naturally from the fact that the outcome of the two other services and NASA as users of the Atlantic Missile Range. Within the **ANSR**, commander Maj. Gen. Donald N. Yates coordinating range operations for the Defense Department and the Florida **comptroller** importance and military independence can be greater than it has in the past.

Col. Herm Fischer, head of the BND detachment at Upp Cassowari, is returning BND headquarters. He will head a new division that will deal with surveillance, a check-out of ranks, supplies at field bases. Fischer is being replaced at AFMTC by Col. Paul Wiggett. —Washington Staff

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**FLEXIBILITY** of coaxial segmented solid propellant rocket nozzle concept being developed by United Technology Corp. is demonstrated with three nozzles which have been fitted with different liners to show how many types of various throat ratings could be formed.

## Segmented Solid Rocket Techniques Hold Promise for Big Boosters

**NOZZLES** of coaxial segmented solid propellant rocket motor (nozzles at left) would be mounted in housing at bottom. Consortium for power separation are made of four or more stages. Some rocket motor is three-dimensional at right.



**TWO-STAGE** rocket motor (left) is formed from coaxial segments. At right above, top segment of a motor assembly has been removed to form a small independent rocket motor.

## Promise for Big Boosters

**SYNTHETIC, COAXIAL-SOLID propellant rocket manufacturing techniques already demonstrated or being explored by United Technologies Corp. under a contract with National Aeronautics and Space Administration are expected to eliminate the need for mobile launching of large solid boosters, cut cost and complexity of production, and lessen the amount of development and test work necessary.**

One of the most promising approaches to building very high thrust boosters of either the liquid or solid-propellant variety appears to be the building-block, or segmented engine. This is now being explored for solids by a number of companies and in the research reported in USAF's upcoming 29-edition of the *Space and Comptech* (AVC Nov. 23, p. 32). It also is being investigated for liquid engines (AVC Feb. 1, p. 16).

United Technologies claims an additional advantage for its approach on solid engines. Because the segments are coaxial in shape rather than cylindrical, with the small end at the top of the engine, the flow area increases in length

as the engine increases in length. This allows almost unlimited increase in length without causing launching problems, more reliable prediction of ballistic performance and decreasing the amount of testing necessary, according to William Schromann, manager of the solid rocket branch.

### Problem Overcome

United has first a small coaxial segmented engine and says that all major design and fabrication problems have been overcome. The NASA contract (AVC June 6, p. 32) calls for demonstration of feasibility of the concept, using a small engine believed to develop less than 70,000 lb thrust. United has proposed building an engine in the 1 million lb thrust class, using segments up to 10 ft long and 10 ft in diameter, and says segments can either be stacked to form one long, large-diameter nozzle or be joined in each segment or group of segments to form a staged rocket.

Segments can be joined in the field with a weight penalty of less than 10% under a method already developed.



**THREE-STAGE** configuration has nozzle below the two top segments, nozzle after the third segment and the third at the base of the rocket. Liquid segments drop off in flight to lighter last, solid caps.

# Defense Objects to Listing Rules In House Conflict-of-Interest Bill

Washington—Department of Defense is trying the Senate to reject a provision in House-passed legislation which would require defense contractors to submit a list of all executive officers and their staff with early retirement proposals (AW Apr 18 p 32).

The provision would also require contractors to furnish lists of all executive officers employed by their subcontractors. The penalty for not complying would be suspension of contractor payments.

In testifying before the Senate Armed Services Committee, on the conflict-of-interest legislation, Charles C. Durant, assistant secretary of defense for manpower, personnel, and readiness, said that the net effect would be a financial hit on the part of contractors to hire any former military officer. He noted that the bulk of World War II officers, generally in the 45-45 year age category, with the rank of major or lieutenant colonel and without "reductions" in the Department, were entering the congressional market in the 1960s at a premium.

The legislation passed by the House appears to be targeting all former or former personnel employed would impose an automatic or company negotiated, pre-employment and less developmental approach through licensing of former projects.

This is advocated by T. Roland Berney, who helped Rep. L. H. Helms, chairman and chief executive officer of the emerging Allis-Chalmers Corporation (AW Mar. 30, p 10). Berney said the company "would suddenly acquire the employment opportunities offered retired officers" and "at a time when we are definitely moving toward a departmental downsizing."

It remains to be seen if the start of conflict-of-interest hearings (AW Apr 24 p 10) before the House Armed Services Committee investigating Subversive Influence by Rep. Edward H. Boland (D-Ma.) will have constitutional great difficulty in name of one people getting compensated.

Defense contractors, in many cases, can be of such great financial significance and can constitute such a major portion of the contractor's total sales that no risk, however minute, would be taken by him which might jeopardize present and/or a defense contract. All would be under contract which supports this contention," he said.

Defense Department position on other key provisions of the conflict-of-interest legislation:

- **Confidential period.** Berney agreed that there should be a transition period for adding contractors to Defense Department lists. He suggested that it should only apply to those with the rank of colonel or captain (mailed) and higher. He said that if lower rank did not have "voluntary"

penalty the provision in the House proposed sections concerning public disclosure of former officials employed by defense contractors. Under questioning, he said he would prefer to have the regular secret, available only to Congress.

- **Definition of "selling."** Berney insisted that this defined definition of "selling" be written into the legislation. Selling would (1) sign a bid, proposal, or contract (2) negotiating a contract or (3) concluding an offer or acceptance of the Department or Defense who is listed with contractors to be used in the preparation for the purchase of (4) obtaining or negotiating contracts, (5) negotiating or discussing changes or specifications, prices, costs, formats, or other terms of a contract, or (6) writing disputes concerning performance of a contract.

The legislation passed by the House simply leaves out mentioning the precise of which it is sell or to bid or assist in the selling of something.

- **Public confinement.** Berney suggested that a court martial

would be held, and if it were, he said it would have to be "just or

not else reprimanded."

- **Public confinement.** Berney suggested

that the provision in the House proposed sections concerning public disclosure of former officials employed by defense contractors. Under questioning, he said he would prefer to have the regular secret, available only to Congress.

• **General penalty.** Berney had no problem on the imposition of criminal penalties—\$10,000 for violation of a non-disclosure agreement—proposed for offering to sell or assist the services of an executive to the services, but is in favor of the contractors who employ them.

Rep. Helms, with the support of the Justice Department, proposed a Senate Armed Services Committee to include

the following in negotiating contracts:

- (1) negotiating or discussing changes or specifications, prices, costs, formats, or other terms of a contract, or

- (2) writing disputes concerning performance of a contract.

Berney declined that a court martial

would ever be held, and if it were, he said it would have to be "just or

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## Cosmic Ray Experiment To Involve 14 Nations

Washington—Offer of Naval Research Lab scientists for participation in the probe balloons carrying an 800-lb. array of particle detectors to record cosmic-ray phenomena at altitudes up to 118,000 ft.

Analysts of recorded data would provide data on interaction of cosmic rays with other particles, which could result in identification of new particles in space. Project scientists estimate that at maximum altitude the condition should not be being impacted 40 times or less by proton cosmic rays.

Twenty-two universities and research organizations in 14 countries were invited to make use of the sounding-vehicle, Project DNA. Nations involved in the program are: United States, United Kingdom, Australia, the Polish Institute for Nuclear Research, Others are the University of Wisconsin, Washington University, University of Chicago, University of Tennessee, University of Rochester and the Naval Research Laboratory in the U.S.; Cambridge National Research Council, Research Center of Physical Research, Warsaw Institute, Israel, Comptech, Ltd., Comptech of Japan, Tata Institute, India, University of Sydney, Australia, University of Bristol, Eng. Univ. of Copenhagen, Denmark, Univ. of Hanover, Germany, Universities of Bonn, Potsdam, Mihra and Town of Dink, and University of Bonn, Switzerland.

The probe payload was to have been purchased from the 100-ft. high by 8-ft. diameter star balloon, T-1, after a record 355-min. flight from the Roosevelt, Ga., launch site. The timing mechanism to separate the payload apparatus, however, preventing tension on whistler. Late in the week, Navy was invoking the balloon with RSD aircraft as the system defined as a west by northwest path of altitude, varying from 114,000 ft. to 65,000 ft.

## News Digest

Federal Aviation Agency's choice of a company to develop a low-cost air traffic control radar transponder for small aircraft is expected to be announced next week. Approximately 20 aircraft manufacturers submitted proposals.

Aerospace-General Corp. has a \$198,000 contract to develop a small radar transponder. NASA will continue a research effort already started in the Navy with hybrid systems which combine liquid readout with solid-state.

AIRPORT WEEK, June 12, 1960



### Fiat G.91T Trainer Makes First Flight

Pratolino, Italy—First flight, record 100 min. and accomplished all test objectives. First and. Delivered by Fiat and West Germany to Italy. G.91T was designed for scheduling and pilot training (AW, Jan. 25, p. 159).



Fokker Aviastra Agusta RH-57, one of two British-built converted for high altitude flight checks, is the aircraft was abandoned in flight last week near Patuxent, Md., when last control stabilizer controls jammed. Two crew members bailed out, landed without injury.

De Havilland Aircraft Co., Ltd., will take over the D.H.113 short-haul passenger plane from the British Manufacturing Co. Ltd., group which includes de Havilland, Hunter Aircraft and Derry Aviation. Since the three are in different groups in the recently reorganized British aircraft industry, they have decided to join in the earlier D.H.121 project in de Havilland Aircraft.

Army-Martin Frobisher test vehicle is fired on a programmed course from Maitland, Florida, Range, last week. NASA will continue a research effort already started in the Navy with hybrid systems which combine liquid readout with solid-state.

Radio Corp. of America was awarded a small task contract last week to increase the capability of radar and

other electronic devices to pick out and identify hostile missile warheads in part of ARPA's proposed Project Phoebe or Purple Range Electromagnetic Signature Study (AW, Apr. 11, p. 33).

Chance-Vought F8U-2N crashed when it failed to gain altitude following full-thrust catapult launch at Patuxent NAS last week. The fighter crashed into a USAF H-34 helicopter serving as a testbed and an ambulance and a fire truck lifting four men.

North American Aviation X-15 rocket research aircraft exploded last week, while undergoing engine tests of the Reaction Motors XLR-99 in Edwards AFB, Calif. The all-new version of the No. 3 aircraft, due for flight test next month, "Stratojet," and the second version, a test pilot seat, Crossfield made was thrown about 70 ft to the base of the hill. Crossfield was not seriously injured. Previous engine tests of XLR-99 have been the 16,000-ft.-thrust XLR-99A. The No. 7 aircraft now is under modification in preparation for installation of the larger XLR-99 engine, and is scheduled for flight in September.



# Capital Management Fights Insurgents

Washington—Capital Airlines' management last week locked out of the Capital shareholders, who in an last attempt to force the company's holdover group from taking a special shareholders meeting to overturn the stockholders' board of directors.

At the same time, the company's management won over a small group of dissidents to its side by raising Charles Y. Bader, New York, investment banker to the head of director Bader in the election of Capital Defenders Holdings Protective Committee.

Meanwhile, the old holdover corner gained a third extension of the proxy hearings brought against it by Vickers Armstrongs and now has until June 27 to submit changes in the director nominations.

The management group opened its fight against the Capital shareholders June 10, appearing some 1,200 on planes of the company, with a letter asking stockholders "to withhold your judgment and sign nothing that will involve your opinions in what we feel is an unnecessary disclosed and expensive meeting." The company began solicitation of stockholders two weeks ago, calling for a special meeting to name a new board of directors.

The letter, which was signed by Capital's Board Chairman Thomas D. Neely and by President David H. Baker, noted that the management "will have the calling of such a meeting until sometime later in Capital." It goes on to add: "In a short time later and even should with that, we will be ample time for us to select who to do what, we have all the facts."

Naming of Bader to the board of directors brings the board to a total of 14 members and shifts the balance of power within the board strongly toward Baker and the present management. Prior to the appointment of Bader, the board consisted of 12 members, equally split down the middle on the question of who should run the company.

At least one attempt was made to unseat Bader from the presidency by a member of the board faction opposing the present management. Another member of the faction cornered and attempted to key Charles MacLean into the board chairmanship in a move to remove management influence. Both attempts failed in a small margin.

Below the board the two holdover factions were seldom settled, and the sharp fight between the two often caused a deadlock on many issues, including the moves out of its financial

fight. However, in the past few weeks, the group opposing Baker has won so many members and the present management were unable to force a vote and with the fall coming of Neely and with the end of the executive committee.

MacLean has been side-tracked, has lost the chairman but has firm hold with the company's legal counsel and has been removed from the executive committee although he remains a member of the board.

Both management and the stockholders' group have been in touch with Vickers Armstrongs. This means that the stockholders' group, long known as the salvation of persons in will or insidious factor, has the government prohibited by the Securities and Exchange Commission, according to its information division, there is strong evidence that the group is not insidious over the situation that it is.

Capital Airlines' Defense Protective Committee, headed by Bader, made solidish progress in the initial stage of its organization. It promptly met with Capital's management, with the Bader Trust Co.—trustee for the executive holdover— and Vickers Armstrongs and with general counsel for both Vickers and the trustee for the note holders.

Capital's management stressed the importance of Bader to the board, as did the note holders.

The annual meeting of your company at which you elected a board of directors took place April 20, a few weeks ago.

At that meeting, Mr. (Cap-

ital shareholders) Armstrong presented

as chairman and solicited an vote in

opposition the director whom you elected.

Since that time Mr. Thomas D. Neely Jr., has been elected a member and chairman of the board of directors.

On June 10, Chairman of the Protection Committee, the chairman of the 40% Controlling Stockholders' Protective Committee of the company, has been

selected a member of the board of directors and its executive committee. It added:

"Now, they [the stockholders] are soliciting your funds and asking for a proxy to call a special meeting to re-elect the board. The replacements are to be nominated by the association, whose members own an average of less than 10 shares per member, and are at our uninsured and uninsured."

Meanwhile, the Capital shareholders officials wrote the letter in an expression of concern on the part of management over the progress the association was making in its move to take over control of the company. The group had it has

no intention of closing down in its drive to overthrow the present board of directors, and the present management were appealing to the federal court and with the fall coming of Neely and with the end of the executive committee.

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WHEEL HOOK of FAA Convair C-131 engins was produced during tests for AF Aerospace Engineering Co's landing system

## Transport 'Hook' Landings Demonstrated

By Harry Tally

Georgetown, Del.—First flight arrived landing of a transport aircraft fitted with a hook landing gear, the first in the United States. The landing gear is part of a project to study the feasibility of hook modifications on transport aircraft.

The study contractor, awarded to All American Engineering Co., Wilmington Del., called for 21 aircraft landing gear with a hook landing gear. The first landing gear is part of a project to study the feasibility of hook modifications on transport aircraft.

The study contractor, awarded to All American Engineering Co., Wilmington Del., called for 21 aircraft landing gear with a hook landing gear. The first landing gear with a hook landing gear was made by All American Engineering Co., a supplier of landing gear to the aircraft industry. The landing gear is designed to provide a greater range of motion than a standard landing gear, allowing the aircraft to land on a steep incline or a flat surface.

According to an emergency company spokesman, the gear would provide added safety in the event of a hard landing. The landing gear is designed to provide a greater range of motion than a standard landing gear, allowing the aircraft to land on a steep incline or a flat surface.

The average speed on landing the gear was 90 ft. Aircraft weight during the test was about 40,000 lb.

All American Engineering's attempt to improve the landing gear of transport aircraft is part of a project to study the feasibility of hook modifications on transport aircraft.

The landing gear, the company's Model 340-D, is a square type which is a hook landing gear which is pulled through a support. The landing gear is designed to provide a greater range of motion than a standard landing gear, allowing the aircraft to land on a steep incline or a flat surface.

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If a reliable landing system could be developed which would engage the gear gear of all transport aircraft, the weight penalty, reported by the project manager, would be only 100 lb per hook. Various materials of French, landing gear and the necessity to use a jet propeller as well as a gear for increased attempts to develop a reliable landing system.

The high cost per landing gear with a hook landing gear led to the installation of hook landing gear on Air Force Convair aircraft fighters. FAA studies also indicate that for reliability the hook is the thing.

### Hook Modified

The hook employed on the FAA Convair C-131 modified version of the aircraft designed by the Navy Douglas 30 aircraft. Modification included lengthening the hook 18 in. to a length of about 5 ft. The hook is fitted to the midsection of the fuselage and were usually fastened to the fuselage of the aircraft. The hook is raised and held in the up position by hydraulic pressure and forced down upon release of pressure by compressed air cylinders. The weight of the extra hook assembly is 110 lb. All American has designed a fair spring steel company landing hook for the Convair F-106 fighter.

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hook is mounted flush to the bulk of the fighter so that only the hook point often reappears to the airman. In an emergency, inflation of a solenoid locking mechanism releases the hook point and the hook springs to the down position. The hook retains its tension, the safety pin against the reason safety pin by means of the spring start, facilitating deployment of the emergency gear.

An installation of this spring steel hook on the Convair would weigh 56 lb., according to All American.

The company has designed a safety sequence type operating system for transport aircraft weighing between 100,000 and 100,000 lb. This system, Model 3000-1000 has never been built. How-

ever All American has proposed installing that system for test purposes at Dulles International Airport, Chantilly, Va. In conjunction with this proposal to the FAA, the company has proposed the installation of one of its sprung steel hooks on a Boeing 727-157 which the FAA is scheduled to review as hardware from the Air Force.

The FAA, which regards these latest proposals as bringing a long-overdue improved system to the National Airspace System, has invited All American to Atlantic City, N.J., the tests are of a proposed system, bridged by the nose wheel, to engage the main landing gear. Results of the tests, which involve two aircraft, will be available in the near term. The configuration, however, has not been announced.

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Based on recorded revenue ton miles of 348,740, CHA has a break-even point of \$3.37 per revenue ton mile, compared with LAA's \$5.15 on 46,725 revenue ton miles and NYA's \$8.15 based on 67,385 revenue ton miles. In the same three-month period, the Chicago carrier earned total ton mile rates of \$4.79, including added premium of 53%.

LAA profited a revenue rate of \$7.16 with sales of \$4.78 and NYA's earnings per revenue ton mile were \$11.53, including added sales of \$5.08.

Total direct expenses per revenue ton mile, including operating, labor, maintenance and fuel, were \$4.13 for CHA, \$7.49 for LAA and \$6.63 for NYA. Total indirect expenses for the three carriers were listed at \$2.74, \$7.66 and \$7.13, respectively.

A breakdown of direct expenses is given by type of equipment on an intra-city basis shows total direct expenses for CHA's 12 passenger S-96 of \$2.22. The five passenger S-65 flown in LAA had expenses of \$1.08 and NYA's 14 passenger V-44B had a total direct operating expense of \$3.97 per revenue ton mile. The figures include, rounded, flying operating, maintenance, administrative, the \$9.71 for the S-96, administrative expenses of \$7.71 for the S-65, the \$1.08 for the V-44 and \$3 for the V-44B, based on total revenue rates of \$16,668, \$15,689 and \$14,835.

Daily utilization rate for CHA's S-96s was 3.4 to 3.5 days, compared with 4 to 4.5 for the S-65 and 4 to 4 for the NYA V-44s. Revenue passenger load factors ranged during the first quarter with 75.1% for the S-96, 54.1% for the S-65 and 66.6% for the V-44.

Total revenue ton miles recorded by Chicago Helicopter Airways increased 312.4% to 188,170 in the first period of this year compared with the same period in 1970. Costs were up 11.5% to 48,725 revenue ton miles, but fuel and NYA's revenue rates helped LAA and NYA's revenue ton miles increased 32.8% to 67,388.

CHA's total revenue increased 35.5% to \$3.32 per revenue ton mile for the first quarter over the same period last year, while total operating expenses decreased by 53.62% from a 1970 figure of \$10.91. In the same period, LAA increased its overall revenues by 41.9% to \$3.38 per ton mile, but registered a 20.6% cut in total operating expenses to \$7.06 per ton mile. NYA's overall revenue decreased 57.7% in the period to \$3.53, while total operating expenses decreased 53.24% to \$12.90 per revenue ton mile.

## FAA Threatens to Suspend Pilots In Dispute Over Flight Inspectors

Washington—Federal Aviation Administration airline pilots will have their certificates suspended until they do not return to the inspection of the FAA despite the pilot of one DC-8, who resented his flight to inspecting him, quit his job.

FAA took the action after Eastern Air Lines pilots had forced cancellation of several flights because pilots refused to take off with an FAA inspector in the seat normally occupied by the third pilot who flies in Eastern's DC-8s according to terms of the airline's contract with the Air Line Pilots Assn.

Eastern, based in a U.S. District Court, requires returning pilots to sign an ALPA and the Alaska Executive Council's memo to remove administrative round-trip round which would interfere with flight operations.

FAA Administrator E. R. Quisenberry said last week that the defiance of the agency had been "unforgivable" challenged" in planes refusing to abort to "reenter" inspections. He announced that FAA had issued a special Civil Air Regulation specifying that all aircraft make available "a seat on the flight deck of each aircraft . . . for inspection."

Special regulation also specifies that no revenue-farmer aircraft having more than one observer seat, the air carrier will sit in the seat directly behind the pilot.

ALPA and FAA appeared to be "immediately referring itself into a legal battle between two private parties." The union and pilots welcome prompt resolution but fear to having crew members displaced. ALPA defended the pilot's action as refusing to fly the jet aircraft without the third pilot in the seat behind the pilot.

Quisenberry said that pilots who refuse to allow to inspect inspection would

be considered unfit to fly aircraft and would have their certificates suspended until they do not return to the inspection of the Eastern despite the pilot of one DC-8, who resented his flight to inspecting him, quit his job.

Eastern's expenses per revenue ton mile, including operating, labor, maintenance and fuel, were \$4.13 for CHA, \$7.49 for LAA and \$6.63 for NYA. Total indirect expenses for the three carriers were listed at \$2.74, \$7.66 and \$7.13, respectively.

Quisenberry and the removal of the third pilot from the seat directly behind the captain to permit the testing of an FAA inspector would not impair the safety of the aircraft in flight. He said the DC-8 was certified for a pilot and a copilot and that an agreement between ALPA and the company was that their aircraft and the option was not an mandatory option.

Quisenberry said the FAA maintains the routine inspections on a non-scheduled basis and checks about 15% of the scheduled flights made in any given period.

He added that the agency will a legal right to conduct these inspections and as far as he is concerned the inspector will sit in the most advantageous seat to conduct inspection.

A meeting was scheduled between FAA and ALPA officials to discuss the issue but because it was held ALPA informed the agency it had no time to meet. The two sides agreed to set up a date of 4 in the next directly before the pilot was swapped by an inspector.

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## Helicopter Carriers File Financial Reports

Washington—Chicago Helicopter Airways reported record ton miles and cash flow in first quarter of 1971, while total operating expenses decreased by 53.62% from a 1970 figure of \$10.91. In the same period, LAA increased its overall revenues by 41.9% to \$3.38 per ton mile, but registered a 20.6% cut in total operating expenses to \$7.06 per ton mile. NYA's overall revenue decreased 57.7% in the period to \$3.53, while total operating expenses decreased 53.24% to \$12.90 per revenue ton mile.



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## Surface-Mail-by-Air Program Attacked

By Paul Kastner

Washington—Rep. Glenn Cannon (D-N.Y.) attacked the Post Office's air mail program last week, arguing that the Postmaster General has no legislative authority to expand the mailing of first class mail and warning that it must be stopped promptly. Railroads backed his stand.

Rep. Cunningham, a member of the House Post Office and Civil Service Committee, told his colleagues that groups Post Office Operators Subcommittee in support of legislation is introduced to prohibit the mailing of mail by air unless it carries airmail postage. He said the Post Office's air mail plan is used to re-quest to public donations, but, except as to offshore posts of Alaska, Alaska and Puerto Rico which clearly present a unique situation, there is no evidence of such claimed. The absence of such evidence warrants his conclusion that the public is satisfied with the choice between surface and aerial which has been in effect for many years.

The Postmaster General's air mail plan has an adverse effect on the railroads. Also, the Postmaster General's mail is in order of its airmail plane he said, has chosen that defense has not been explained that it cost the Post Office Department many taxes, and that many have been discontinued against.

Cunningham's remarks were in direct contrast to the stand taken by the Senate Post Office Subcommittee headed by Sen. A. S. Mike Monroney (D-Okl.). Last August the subcommittee recommended "after careful study that the Postmaster General does have the authority to transport classes of mail by air, and that, in the course of its study, the Postmaster General has the power to make final" the Civil Aeronautics Board.

Rep. Ralph J. Flanders (D-Vt.) agreed before the House group in opposition to the Cunningham bill, while noting the measure is a "step backward in a rapidly moving nation." He said mail moving by boat from South to Alaska involves a trip using from 960 to 1,080 m. and takes from 10 to 15 days. Air transportation is necessary, he said.

Rep. David K. Ives (D-Hawaii) also protested the Cunningham bill as the measure that "will not only increase costs with mail to the Pacific Islands and the mainland. Right, first class mail from Washington to Honolulu requires an airmail, of eight to 14 days by air."

Cunningham admitted that the situation with off-air mail is different from domestic mail service and said that the subcommittee would consider amendment of the bill as proposed last week. He was representing railroad groups that have been in support of the Cunningham bill, claiming its proposal is necessary to ensure the survival of airmail.

Rep. Bert B. Bishop (Dem., Robin, Calif.) transportation Division, Association of Local Transport Airlines, the Post Office Department and representatives of individual air-

mailers of American Railroads, gave these groups support for supporting the legislation.

"H. R. 1020, as it stands, is likely to do the railroads and all the other surface mailers regarding users of the service to pay airmail postage for air service mail contracts and practices the same concept except that one should pay for service, another not."

"The air mail plan is used to re-quest to public donations, but, except as to offshore posts of Alaska, Alaska and Puerto Rico which clearly present a unique situation, there is no evidence of such claimed. The absence of such evidence warrants his conclusion that the public is satisfied with the choice between surface and aerial which has been in effect for many years."

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Mail revenues are a very substantial portion of our total passenger business earnings and contributed more than a substantial share of profit margins for the operation of some of our passenger trains, he said. "Should we use the railroads post office, areas which are congested apparently, instead of which are not, we can put a number of railroads in a better position to maintain the railroads in all probability will necessitate having to add permission to withdraw some trains."

Charles E. Keel, vice president of the Brotherhood of Locomotive and Steamship Clerks Freight Handlers, Express and Station Engineers, warned the railroads that some of our passenger trains, he said, "should we use the railroads post office, areas which are congested apparently, instead of which are not, we can put a number of railroads in a better position to maintain the railroads in all probability will necessitate having to add permission to withdraw some trains."

"We are not sure that Congress is fully cognizant of the fact that not only during those troubled times but for all times an adequate national railroad transportation system can be maintained regardless of the cost thereof," he said. "In the continued return and transportation of fuel-chemicals and fuel-oil cars on the surface and prevent the subordination of an adequate national rail transportation system for our national defense."

Subsidized to railroads an opportunity to the Cunningham bill has not work well in the Air Transport Association, the Association of Local Transport Airlines, the Post Office Department and representatives of individual air-



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## ...MEANS BETTER WEAPONS FOR DEFENCE TOMORROW

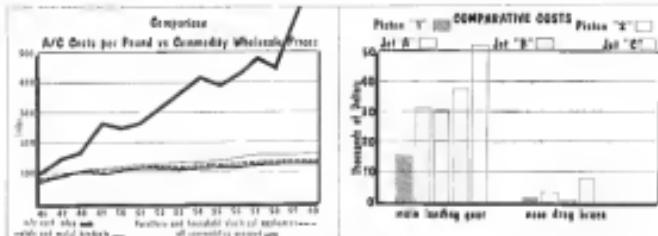
The vast research and development facilities of Britain's major manufacturers—Armstrong Whitworth Aircraft, G.E.C. and Sperry Gyroscope Co.—are constantly being used to improve the performance of this ship-to-air missile system. Already Seaslug is established as the most accurate weapon in its class. Several hundred missiles have been fired with outstanding success from both land and ship-borne installations. But, as the new breed of weapon, existing standards will be developed to give even greater performance. The improvements already made in the three principal subsystems promises the success of even more formidable defensive weapons in the future.

The improvements already made in the three principal subsystems promises the success of even more formidable defensive weapons in the future.

**SEASLUG**

Designed  
and  
Manufactured  
by:

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD  
(a member of Hawker Siddeley)  
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND  
SPERRY GYROSCOPE CO. LTD. OF ENGLAND



AVIATION COSTS per pound are compared in chart at left with wholesale prices of metals and metal products, and domestic and household electrical appliances. Chart at right shows comparative costs of different jet aircraft models

## TWA Scores Jet Airliner Parts Pricing

By David H. Hofmann

Kenneth Cohn, Mo-1st aircraft parts manager for aircraft maintenance and arbitration, has been instrumental in saving the company \$100,000 in aircraft parts costs. TWA's World Airlines top management held a special meeting of 34 suppliers and airlines here.

At the meeting, attention shifted from budgeting attention to increased aircraft and space vehicles. TWA's spokesman emphasized the airlines' status as increasing importance in comparison of commercial and military commanding better service from their vendors.

J. A. Sennott, director of technical purchasing for TWA, and the airline's supplier liaison manager, said these two factors who present in testing the aerospace industry, "in the 25 years of a 95% customer will find their box of cards for parts and supplies suddenly stopped."

Holding the annual spot of commercial parts will free value control for procurement in new jet transports and R.R. M. Davis, TWA's vice president for technical services who opened the conference for 132 representatives of the manufacturing and vendor industry. Reduced material costs which are now between 60% and 70% of the original procurement cost, and the economies needed to live in this field without much of the income needed. Thus, at least will increase the demand for parts and supplies as carriers expand their air fleets to accommodate what is currently a small but untapped market. Davis predicted.

Specifically, TWA charged that procurement standards, besides improving the parts were goals of:

- Providing new products a short adequate procurement, evaluation and training due to grade the carriers in their usage.

• Relating to supplier price a relationship, thereby, forcing the airlines to implement standards that should be required for maximum economy.

• Ensuring to keep adequate inventories in anticipation of future rates so that lead times in aircraft part orders would range from 70 to 180 days.

• Ensuring that subcontractors on notable components without determining which firm available would do the job for the lowest price.

• Neglecting to standardize parts that should be interchangeable on account of the same source.

• Ignoring the availability record of a

given component used and maintained in more than one vendor. Adding the performance of a troublesome part in the field often would increase repair costs, or maintenance procedures and thus increase the necessity for early design changes, TWA said.

Taken together, such shortcomings as "lowering the inherent productivity of the jet transport," TWA's original estimate was that the Boeing 707 would return few times more in revenue than a medium priced plane and white metal being about twice as much.

Buy in aircraft parts, according to Davis, the target is cutting about

### TWA Inventory Breakdown

	Before jet	After jet
Expendable stores (\$4,000 typed)	12,313,500	12,511,900
Rapid parts	12,375,400	12,452,800
Passenger service	297,000	318,100
Base maintenance	3,279,500	3,467,900
Established—Engines and crews (\$4,000 typed)	13,589,300	14,209,900
Engines and power pack	10,717,000	11,758,800
Propellers	2,805,000	3,477,900
Radio	2,931,000	2,721,200
Accessories	14,218,000	16,855,500
Miscellaneous	5,16,903,000	5,49,325,200
Purchased	5,125,100	5,081,100
Total	56,840,100	57,106,200
Aircraft value	234,415,600	332,137,500
Per cent inventory investment in first aircraft	21%	32%
First	10% aircraft	18% aircraft
	11 types	12 types



# TRANS-CANADA AIR LINES ORDERS MORE VICKERS VANGUARDS



TRANS-CANADA AIR LINES has ordered three more Vanguards. This raises their total order to 23.

TCA President, Mr. Gander McGregor said, "The most exhaustive studies by TCA's engineers have convinced me that the Vanguard will be the finest aircraft of its class in the 1960's, with exceptional passenger appeal and extremely low operating costs."

Mr. McGregor's confidence is well placed. The

Vanguard goes to TCA with all the engineering experience and more than 2,000,000 Vickers turbo-prop hours "built in" to the design. It is the world's only aircraft guaranteed turbo-prop airliner.

Big, roomy and comfortable, the Vanguard is built to pace the jets. In fact, this four-engine turbo-prop can generally show a better "block time" on short to medium haul routes than comparable pure-jets—

and in far more economical and flexible. TCA intends to operate its Vanguards on medium range routes in North America and the West Indies. Each will carry 100 passengers in modern luxury, plus four and a half tons of freight.

The Vanguard's cargo capacity is another notable feature of this outstanding plane. Its two large holds can accommodate up to ten tons of freight, so that

with only 30 passengers aboard, the Vanguard can still make a handsome profit as a freighter.

We congratulate Trans-Canada Air Lines on their choice of the Vanguard. Planned to produce high operating profits, this newest of the turbo-props is the most advanced aircraft ever designed for commercial operation. For further details contact Christopher Clarkson, 10 Rockefeller Plaza, New York 20, N.Y.

ANNOUNCED FROM THE WORLD LEADER IN JET-PROP AIRCRAFT...  
POWERED BY FOUR ROLLS-ROYCE TURBO-PROPS

**VANGUARD**  
VICKERS AIRCRAFT COMPANY LTD. • MELBOURNE, AUSTRALIA • MEMBER OF THE VICKERS GROUP

**Airline Income & Expenses—1st Quarter, 1960**  
(In Dollars)

	Passenger Revenue	U. S. Mail	Freight <sup>1</sup>	Charter	Rental/ Surcharges	Total Operating Revenue	Total Operating Expenses	Net Income Before Taxes
<b>DOMESTIC TRUNK</b>								
American	61,312,947	1,441,378	7,361,239	64,416		79,991,595	73,449,454	-1,451,194
Brussels	13,081,176	412,331	323,239	88,439		17,823,267	17,426,666	-393,643
Capital	91,011,493	342,818	550,114	2,032		98,664,416	98,440,939	-2,224
Continental	12,381,772	3,000,000	1,000,000	29,297		16,381,772	15,981,459	-400,313
Delta	27,710,289	987,028	1,728,378	20,216		39,193,626	38,216,332	-983,303
Eastern	44,842,157	1,916,324	8,096,410	100,739		58,891,480	59,416,448	161,453
International	17,384,264	311,394	1,020,316	10,844		19,541,249	19,356,618	194,793
Kentucky	8,772,272	1,000,000	1,000,000	1,200		10,974,472	10,774,472	-200,000
Northwest	19,818,581	613,364	1,070,461	42,015		31,656,616	31,116,834	541,992
Trans World	22,322,193	1,715,601	2,647,415	40,919		44,299,947	43,705,365	-593,280
United	29,932,009	2,387,864	3,427,845	97,177		59,241,045	59,039,942	-1,201,001
Western	15,164,419	344,750	546,441	56,187		34,301,964	34,165,436	1,196,594
<b>INTERNATIONAL</b>								
American	1,762,002	9,154	146,033			1,891,404	1,747,847	143,556
Brussels	1,762,641	41,445	146,880			2,008,147	1,854,898	-153,251
Caribbean Airlines	849,449	2,800	40,239	2,419		929,108	787,179	142,029
Delta	1,012,289	12,000	1,000,000	1,000		2,024,389	1,924,389	-100,000
Eastern	4,049,067	527,003	249,450	11,470		4,667,063	4,546,633	-120,430
Maya	597,103			18,441		597,103	541,766	53,338
Northeast	200,364	1,234	20,361	19,381		220,364	212,237	-112,214
Northwest	4,142,113	1,000,000	1,000,000	1,000		4,142,113	4,082,113	-60,000
Pan American Combined	67,147,113	8,749,594	10,164,645	1,100,895		85,057,070	80,107,115	-4,950,957
Air Asia	705,497	44,189	9,945	2,125		836,736	812,235	-182,518
Athens	18,162,278	1,993,123	6,017,736	658,213		22,867,984	21,310,448	-156,535
Caribbean Airlines	1,000,000	1,000,000	1,000,000	1,000		2,000,000	1,924,389	-75,611
Pacific	16,264,428	2,135,487	2,155,257	10,817		24,832,924	24,217,114	-615,494
Panama	3,623,204	145,607	709,838	12,385		8,701,978	8,426,938	274,040
Rangoon	1,000,000	1,000,000	1,000,000	1,000		1,000,000	1,000,000	0
Taiwan, Republic of	10,054,713	1,384,026	7,420,000	370,381		16,239,402	15,816,738	-420,264
Trans World	9,815,423	107,600	71,884	37,510		9,897,681	9,779,929	118,152
United	1,244,766	9,650	10,891			1,257,761	1,184,930	169,830
<b>LONG-HAUL SERVICE</b>								
Air France	1,441,803	31,676	105,431	1,344	100,311	2,431,311	2,431,935	-624,624
Air India	1,773,247	10,796	22,349	14,845	27,458	1,791,723	1,715,289	-77,434
Continental	1,410,163	18,095	27,422	6,124	149,372	1,327,078	1,322,499	-176,221
Pan American	1,347,424	41,341	106,911	25,434	149,319	2,048,491	1,986,646	-161,854
Latin American	1,000,000	1,000,000	1,000,000	1,000		1,000,000	1,000,000	0
Malta	1,018,261	26,740	44,750	20,373	434,152	2,362,942	2,277,940	-865,997
Middle Eastern	9,691,193	65,764	14,836	56,479	1,348,710	9,449,634	8,656,497	-786,033
Qantas	1,321,419	39,705	90,919	3,259	476,118	2,302,275	2,175,397	-126,999
Scandinavian	1,220,239	1,000,000	1,000,000	1,000		2,220,239	2,175,717	-44,522
Swissair	1,341,848	23,201	38,819	28,270	495,372	2,484,427	2,120,120	-364,308
Transair	831,851	31,486	48,448	3,304	454,152	1,604,954	1,463,137	-341,813
Trans World	1,000,000	97,446	70,826	19,102	791,160	1,900,000	1,800,000	100,000
United	1,274,474	25,762	25,762	1,742	130,173	2,320,317	2,227,893	94,424
<b>REGIONS</b>								
Africa	554,381	5,484	21,710	38,191		5,984,809	5,110,118	-77,691
Hawaiian	1,620,030	1,077	320,327	301,677		2,160,278	2,084,349	-166,931
<b>CARGO LINES</b>								
AMC	3,245,649		41,406			3,246,919	3,246,418	441,513
American-Andean-American	1,000,000	1,000,000	1,000,000	1,000		1,000,000	731,704	268,296
Flying Tiger	14,212	2,027,486	2,001,200	1,000		6,830,346	6,931,821	-121,481
Embra	20,615	1,010,499	60,197	1,000		1,034,664	1,071,193	-386,529
Scandinavian & Western <sup>2</sup>	1,000	1,000	1,000	1,000		2,000,000	2,000,000	0
Malta	5,000,000	5,000,000	5,000,000	5,000,000		5,000,000	5,000,000	0
<b>MICROFLITE LINES</b>								
Other Industries	179,392	8,034	3,410	1,074	234,120	216,392	190,560	-28,991
Los Angeles Airways	41,919	16,159	40,400	174	201,143	448,365	1,041,023	14,673
New York Airways	212,489	12,417	23,320	1,000	343,020	215,167	893,568	-114,447
<b>AMERICA 1960</b>								
Airline Airlines	470,872	106,838	123,116	603,204	331,794	8,703,417	1,941,914	-6,761,503
Airline Central	100,400	100,400	100,400	100,400	100,400	122,729	122,729	0
Caribair	27,454	17,119	80,179	80,179	80,179	226,279	230,812	-5,533
Fiji	110,836	10,330	14,585	20,605	120,837	298,132	299,131	-4,490
Malta Consolidated	150,312	104,349	81,400	30,374	306,374	400,348	707,261	-306,887
Pacific Northwest	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	0
Trans Airline	200,375	111,389	94,102	74,734	200,375	208,496	241,494	-134,999
West Africa	143,519	141,544	74,365	58,800	741,209	1,176,356	1,034,204	174,030

<sup>1</sup> Not available

<sup>2</sup> Property indicates use of freight aircraft & revenue baggage revenue

<sup>3</sup> Malabar operations suspended Mar. 10

Compiled by Aviation Week from airline reports to the Civil Aeronautics Board

# ROHR-BUILT JET PODS

## ON THE WING



The Convair 880 . . .  
newest and fastest of America's  
commercial jet airliners.

Rob builds the complex, ready-to-install jet pod units (shown above) for this great new airliner. They represent but one of the many major aircraft assemblies that have built Rob's reputation as the world's largest producer of components for flight.



Chula Vista and Riverside, California



PHOTO of hydroelectric installations at Bortles-Degrem, France, was made by Capt. Ronald Yeager in an RF-101C.

## Ground, Air Planning Accelerate RF-101C

McDONNELL RF-101C lands on runway during Ruff-Fluff Fire reconnaissance mission

By David A. Anderson

**BONNAGART, Germany** — McDonnell RF-101C Voodoo reconnaissance pilots of the USAF's 60th Tactical Reconnaissance Wing are struggling in 12 gulls on training missions with the aide of the Iron Carpet.

That requires speed — over 600 miles per hour — of the well-planned, well-rehearsed operations of the Wing, starting with the arrival of the ground power supply, running the mission, the landing, then of ground crews, concern, turbulence and photo interpretation and ending with the pilots who sort out the data.

Clock seems from the 60th Wing computed in NATO's big annual aerial reconnaissance exercise, Ruff-Fluff Five held this year at French AFB Amherin 116 near the German village



## AERONAUTICAL ENGINEERING



Pilot of RF-101C from 60th Tactical Reconnaissance Wing stands near aircraft (left) after sharp climbing turn after takeoff.



RETURNING from photo mission, Voodoo picks up dust for landing deceleration, comes in a dogleg. Note fire under one engine.

## Scramble Rate

at the edge of the Black Forest. In spite of those operational problems, the 60th crews lost out in final point scoring to Republic RF-84F units from the Royal Netherlands Air Force, and Canberra FB-7 units of the Royal Air Force (AW June 5 p. 75).

They were matched against the Dutch on medium range missions down over a dogleg area, a total track distance of about 315 miles. The average speed in that event was about 675. They tackled the Ruff in long-range missions of about 980 over a total track distance and came within less than 1% of the Canberra units' score. The RF-101C crews picked up 4,512 points against the RF-101C's 4,491.

The 60th Tactical Reconnaissance Wing is made up of two combined squadrons, the 17th and 18th TAC



TECHNICIANS from around country interpretively the engine the Voodoo's engine is on



## COUNTER-COUNTERMEASURES

... accentuate the positive . . . eliminate the negative

Effective air defense requires high resolution radar analysis and accurate tracking data for weapon control. Enemy jamming is intended to degrade resolution and accuracy, and corrupt the data processing system.

Bendix, as a prime supplier of the "solar eyes" of air defense, is developing new radar and data processing techniques to permit weapon management and control in the face of such enemy jamming. A special simulation facility has been developed at the Bendix Systems Division to evaluate new techniques and concepts in real time. Both automatic and semi-

automatic methods are being tested. The purpose of the facility is to establish the optimum balance of man and machine functions.

The Air Force program involves system analysis, equipment evaluation, computer design, human factors, and operations research. The results of the investigations are being used as a basis for planning future Air Force programs. It is typical of advanced systems programs being carried out by the Bendix Systems Division. Better engineers and scientists interested in processing systems of the future are invited to join this growing team.

Bendix Systems Division  
ANN ARBOR, MICHIGAN



**CAMERA RAY** is opened at left and television cameras are set up in the pilot house to assist the analyst to make his "hot" report and more detailed "transistor" report. At right, MSgt. Bledder carries a film magazine and loads for camera sections on the rear



Capt. Young, Hartson and Fouleck on the long range mission

### Royal Flash Missions

The Air Force pilots who competed in Royal Flash were chosen in a difficult road racing contest which included their photo and racing performance.



**ALL CAMERAS UNLOADED.** the empty nose section of the McDonnell RF-101C is ready for unloading for the next mission

## Basic as bread... is the role of electronic instrumentation in human progress

And often, as close to home • Here, a food processor relies upon a Beckman oxygen analyzer to guarantee the freshness and flavor of orange juice. There, using ultracentrifuge, electrophoresis apparatus and chromatograph, immunochemists isolate ragweed allergens in the fight to control hay fever. Farther afield, a Beckman high temperature ceramic potentiometer helps launch and guide a missile • Everywhere, in the pursuit of quality, the quest for a cure, the maintenance of leadership—Beckman is part of the plan. And wherever they are—in the laboratory, in the factory or in space—Beckman components, instruments and systems are basic • They are the things on which Beckman builds its success, upon which users of Beckman products build theirs.



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ground crews and maintenance personnel which were the best the Wing had.

"During the month," said one evaluation pilot, "we sent them out over the airfield that had no 96 airfields as it. They had to make one pass, photograph the field, and get in the sand box report from visual reconnaissance on board. One pilot estimated the field had 61 aircraft and another said 67."

Another run of four flights was a mixed load with 251 men. One pilot reported 251 men and the other said there were 250. "That'll give you an idea of how good these pilots are."

Most of the professionals in the photo-reconnaissance business who attended the NATO course in observer or commander agreed that the 96s photo-bought back in Capt. Ronald Yenger of the 96th Wing topped the rest in pictures, perfection. The shot was taken parallel to the face of a long dam at Borsig-Oeges, 35 mi. southwest of Clement-Ferroud, France. Yenger was flying at 200 ft. and 500 ft., and took his pictures with the infraredique nose camera.

The original print shows applies in the water and less landscape details with high clarity and contrast.

Yenger flew most of the Wing's flights, has something over 300 hr. on the RF-101C and knows the airplane and its systems. His average score on the first pass was made a little closer than the usual flight speeds of the RF-101C: 100, 420 or 450 ft., depending on environmental conditions. There was considerable low-level turbulence that day, and Yenger was increasing his altitude to ride out afternoon thunderstorms.

Yenger passed the day at 1412 hr. and got his share in routine flights.

### Morning Briefings

Central briefing for the day's missions was held in the morning at eight a-clock, pilots were briefed on weather for the day, the airfields, fields and airfield conditions of general value. Nothing was said about targets at this briefing. It also provided an opportunity for competing forces to make mutual understandings on a number of items which generally were being interrogated over the airfield.

One morning the discussion included an argument on what can be seen by the winds. "In the vicinity of a deflection of the center of the airfield—a check point to determine the accuracy of that specific kind of target name, and which direction is consider clockwise."

After the briefing, pilots assigned to the day's mission headed for tracks near their implants and waited until 11:45 a.m.—one o'clock—scheduled damage the target, but delayed over until 11

AVIATION WEEK, June 13, 1960



## What's Behind This?

a major advance in the state of infrared art

by HIRSH-SINGER, INC.

At long last HIRSH is permitted to advise openly their relationship to the revolutionary "Mandrill Step." Taken with IR equipment developed at HIRSH-SINGER. The map-like image was photographed under conditions of complete darkness. Amazingly clear, accurate and continuous data of the Mandrill terrain resulted.

IR surveillance equipment which meets military requirements, is continually being developed and improved at HIRSH-SINGER. Although RECONNEX, the code name applied to HIRSH IR equipment has been employed primarily in aircraft, it could be used in other vehicles such as satellites for scanning areas several hundred miles wide.

If you are interested in HIRSH's outstanding advances in the development of new concepts and systems for reconnaissance, surveillance, and infrared detection—military and industrial—please write to us to know, contact HIRSH-SINGER, Dept. L.

**ELECTRONIC RESEARCH AND DEVELOPMENT in the areas of:**  
Communications • Countermeasures • Reconnaissance • Human Factors • Intelligence  
• Weapons Systems Studies and Analysis • Nuclear Physics • Operations Research  
• Antenna Systems • Astrophysics

**HIRSH-SINGER, INC.**  
A SUBSIDIARY OF THE SINGER MANUFACTURING COMPANY  
Singer Park, State College, Pa.





# NEW MAGNETRON FOR RELIABLE FREQUENCY DIVERSITY RADAR

Frequency diversity and higher definition airborne radars are achievable with a new listing Industrial X-band hydraulically tunable Magnetron.

This tube is another in the growing family of hydraulically tuned tubes. Magnetrons we integrated into programs for new equipment and retrofit frequency diversity requirements.

Designated the type L-3305, this Magnetron can be tuned at rates up to 300,000 megacycles per second over the frequency range of 8600 to 9500 megacycles. Pulse stability at peak power output in excess of 50 kilowatts is maintained while the tube is tuned at these extremely rapid rates.

Reliability, long life both in service and on the shelf and maximum self power capability in any tune set facilitate the use of this magnetically controlled tube.

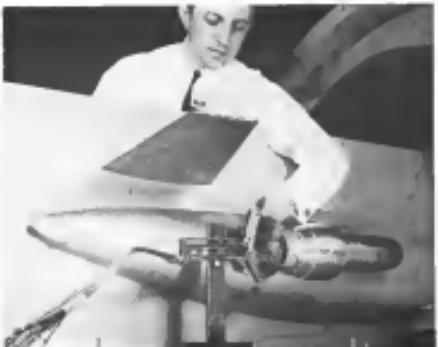
We will gladly send you additional information, if you will write to Litton Industries, Electron Tube Division, Office A-14, 360 Industrial Road, San Carlos, California.

**LITTON INDUSTRIES** Electron Tube Division  
BARATRON<sup>TM</sup> TRANSMITTING TUBES • MAGNETRONS • KLYSTRONS • TRAVELING WAVE TUBES • BACKWARD WAVE OSCILLATORS • GAS DISCHARGE TUBES • NOISE SOURCES • CROSS-FIELD AMPLIFIERS • HIGH DEFINITION CRT • DIRECT-WRITING CRT COLOR CRT • STORAGE TUBES • MICROWAVE FILTERS • DIPLEXERS • TR TUBES

The ruggedized design permits application of the L-3305 Magnetron where severe shock and vibration conditions may exist. The hydraulically actuated is an integral part of the tube design, resulting in accurate, positive tuning action. Provision is made for the adjustment of the hydraulically controlled valve directly to the vacuum, ensuring nearly zero error, maximum reliability and ease of maintainability. Flexibility of system design is possible since the compact power supply and reservoir system may be remotely located.

Reliability, long life both in service and on the shelf and maximum self power capability in any tune set facilitate the use of this magnetically controlled tube.

We will gladly send you additional information, if you will write to Litton Industries, Electron Tube Division, Office A-14, 360 Industrial Road, San Carlos, California.



## GE Studies Caravelle Thrust Reverser Design

Wood model tests of scale model of General Electric-powered Caravelle VII are being conducted to determine operating characteristics of GE's thrust reverser. Reverser designed to deliver 1,800 lb. reverse thrust shows extremely promising part of the afterbody of checklist model. At an L-3305, a Motor through annular engine and valve units, enabling engines to withstand effects of the hot reverse thrust gases on bearing, empennage flap, safety and loss.

On by weather-in got their final season heating. This came in the form of a stand-alone heating, as wiring had to run to them in a sealed envelope by one of the pilots. The engine started when the pilot got the envelope. The plane began to roll down the runway.

He had a maximum of 40 sec. to start the heating, plug in his flight, get into the cockpit and start to roll.

Here's one reason looked back

the 56th Wing's requirements, sprawled out in one of the three disposal areas of the French fighter-bomber base.

**Mission Activity**

The instrument burst out of the trailer, propelling the flight of stops and almost left into a window. At 1000 feet up, As it started to pull out of the trailer area, pilot-overhead, the plane began a wild zig-zag to the cover starting near the distant steel

the last few items on his takeoff check list and started the engine.

On signal the pilot started his roll and the bomb started to roll. The timer stopped when the pilot got the envelope. The plane began to roll down the runway.

Traffic control during the encounter was somewhat of a problem, not only because of the number of airplanes participating, but also because the French air force was operating in F-86 fighter-bomber outfit out of the base right through the encounter. Landing problems were expected to give some trouble, also, and so it was decided for those and other reasons that timing would come during portions of the mission between engine start and roll-off, and between the plane over the forest at the end of the mission and the base.

**Takoff Timing**

A judge on a jury ruled the RF-101C out at the end of the mission and picked well off the base from the engine. The Voodoo rolled into position angled to the runway while the pilot sat up in the engine hatch left and right alternately. Then he slowly rolled out to line up for roll-off. He held the brakes while the engine blazed to full power. Launched in the afterburner with cooling beams that rolled across the flight line, and started



## Unique combination of advantages in GE/STOR aircraft pumps

The GE/STOR pump is a positive displacement pump which can pump any liquid or slurry at constant pressure in speed. It is a form of external gear pump - simple and compact in basic design. It has no moving parts. It is lightweight, reliable, has exceptional performance at high altitudes and has long mean time between failure. In addition, it is lubricated and extremely quiet in operation.

• Strength and ruggedness of the GE/STOR pump is relatively simple. The moving elements are the teeth and body parts in the same direction and either side may be driven. The outer housing always has two lead seals which are extremely leak-tight. The outer housing provides a chamber to move the fluid from the inlet or suction port to the discharge port. (See Figure 1.)



• Low vibration caused and closely held clearance between the two driving elements assure high mechanical efficiency is maintained.

• Low operating cost of the GE/STOR pump is a result of the simplicity of the design. The lack of valves and discharge parts results in avoidance of the valves check, rapid pressure change and turbulence which in other types of pumps can result in high mechanical efficiency. Thus, GE/STOR pumps offer exceptionally good performance at high altitudes.

• Variable speed features absence of mechanical friction associated with the operating mechanism and reverse and variable problems inherent in valve pumps.

• Applications for GE/STOR aircraft pump lie in the range of pressures up to 1000 psi. They are suitable for low pressure hydraulic and servo systems, aircraft fuel and oil systems, aircraft bleed air systems, pressurized cabin air, aircraft air-to-air refueling, aircraft ground support equipment, and similar applications.

• Testbed data—available and peer reviewed—over 20 years.

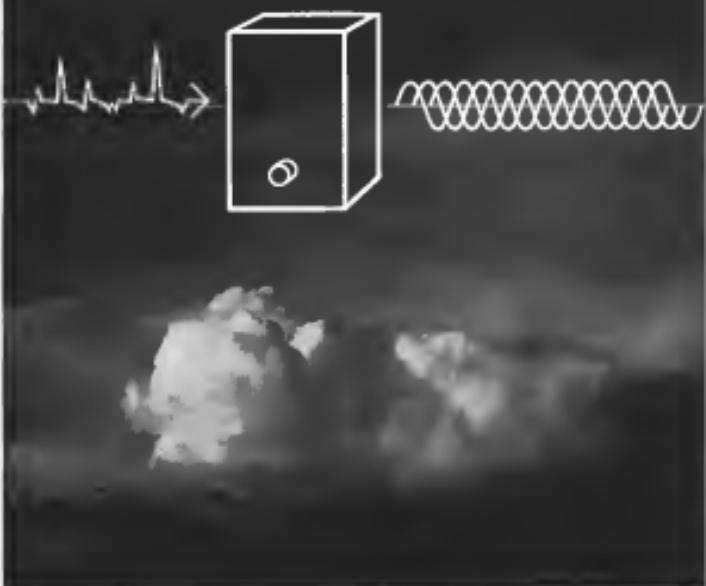
**W. H. NICHOLS CO.**

© 1966 Arthur William H. Nichols Co.

CAPABILITY  
THAT CAN CHANGE  
YOUR PLANNING

# POWER INVERSION

# FOR ANY ENVIRONMENT



New Hamilton Standard developments mark significant advances in static inverter performance, reliability

- Operating ambient from -55 to +125°C
- Frequency regulation to  $\pm 1\%$  cps
- Voltage regulation to  $\pm 0.67\%$
- Efficiency greater than 88%
- Transient and overload protection

These characteristics represent major improvements in inverter performance—improved performance without sacrifice of reliability. In fact, Hamilton Standard has achieved constant reliability increases in all inverters now under development. The development program includes inverters with extremely favorable power-to-weight ratios and output magnitudes from 15 to 10,000 cps, single or polyphase, 60 or 400 cps, square or sine wave.

OTHER POWER CONVERSION EQUIPMENT, produced by Hamilton Standard, includes static inverters (AC-AC, DC-DC), static power supplies (AC-DC), inductor separators, and thermoelectric converters.

NEW POWER CONVERSION PROJECTS are in advanced stages of study at Hamilton Standard:

- Constant frequency input/variable frequency output
- Variable frequency input/constant frequency output
- Bidirectional variable input/controlled variable output
- Static circuit protection
- Controls for fast cyclics

ADVANCED POWER SOURCE DEVELOPMENT is just one of the areas of electronics in which Hamilton Standard is working today. The company's experience also includes instrumentation, measuring, and aerospace flight control systems for aircraft and missiles. These same techniques developed in producing defense products for environmental conditioning, power, starters, turbines and rocket fuel control, propellants and ground support equipment, establish Hamilton Standard as a dependable source of widely diversified electronics capabilities.

WHATSOEVER YOUR REQUIREMENTS in power inversion are, Hamilton Standard can serve you well. For full details write Hamilton Standard Electronics Department, 70 Main Street, Bridgeport, Connecticut.

  
**HAMILTON STANDARD**  
DIVISION OF UNITED AIRCRAFT CORPORATION

WINDSOR LOCKS, CONNECTICUT

## SOME OF THE MANY FIELDS OF GROWTH AT HAMILTON STANDARD



MECHANICAL CONDITIONING SYSTEMS for space vehicles and earth defense equipment such as the B-52, B-10, B-70 are important aspects of Hamilton Standard diversification.



MECHANICAL POWER SYSTEMS to over 20,000 horsepower have been developed by Hamilton Standard. The company's facilities and work include advanced rocket engines.



GROUND SUPPORT EQUIPMENT. Hamilton Standard is presently producing a wide range of GSE for both civilian and air craft—chemical special tools to complete systems.



### Helicopter Turret Uses Remote Control

Lightweight turret system for helicopter provides remote control for external assistance or battlefield surveillance television camera. Unit shown here weighs 16.69 lb. 7.62 mm machine gun. System was General Electric's Model Production System. Cockpit can be located in a fixed or a mobile position.

During flight out of the field, he swung into his private cockpit, the special blades and dropped the gear and flap for landing. Then, came the ascent, and then a long low approach from sea, not brought the Voodoo into a searching landing with hits striking marks on impact. The pilot popped the hook shot, and the Voodoo dropped in a stop down the runway.

Back toward the instrument panel, he saw an LRU check, walking untroubled in the blood from the tail pipes. Next, the avionics, the pilot selected the chart, and turned toward his final soft landing.

But the Voodoo was closing for altitude in tight turns right of the nose, and the pilot was unable to make an early left of a nuclear offense to a recall. A Voodoo was turning left out of the field, nose cladding sharply when a Thunderbird from Second AFM swooped over the field low and fast in his checking pass at the end of a runway. He was supposed to repeat his remark one and four 1,000 ft. and some observers, but did not repeat and came in at about 300 ft., running along the runway to the left of the line with.

### Near Miss

The meteorite seemed just above the dragon area for Second AFM, but the cockpit was not hit for several impacts in an intense rain.

Twenty minutes later, he and Earth, the Voodoo's pilot reported in and landed across the field on a blustering helicopter run followed by an upward climb still

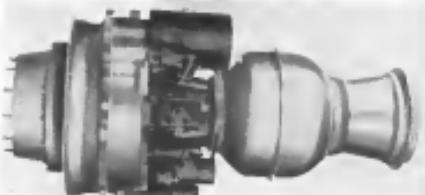
Ground crews stood by, waiting for his signal to dash into position and remove the camera magazines. At the head of the ground markings stood a traffic director, signaling the Voodoo pilot into position. Left of the cockpit stood the crew chief holding the boarding ladder, and in semi-circles, left and right, waited groups of mechanics.

Gangs open, the Voodoo landed and the landing gear was held with two fingers extended, giving the ground crew the numbers and position of the camera which had been used. Slowly the plane rolled to position and came to a stop. Then, the ground crew, the traffic controller, signaled for engine cutoff and the technicians made a dash for the engine.

### Film Removed

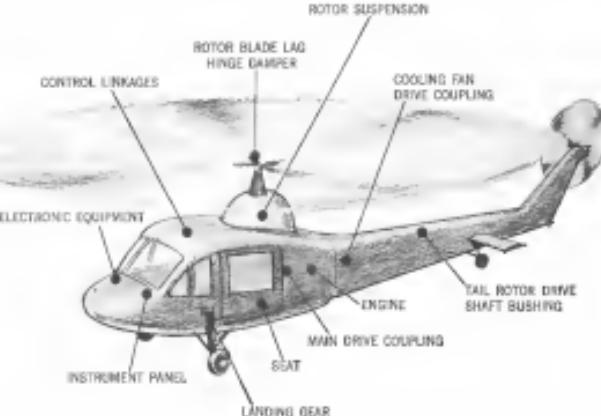
They opened quick-release fasteners, lifted the side hatch of the camera compartments and went to work, on the negatives. In a matter of a few seconds one crewman after another made a dash across the concrete instrument floor, carrying a heavy film magazine to the trailer for developing and processing. The pilot unclipped out and down the hatch to start his "hot report" and within a few minutes another crewman was being whisked to the data furnished by the wet negatives inside the processing trailer. Later, after only a few minutes later—there would be time for a more detailed report, the "translators" report—which would include a thorough analysis of target parameters and a complete report on their characteristics.

In the meantime, a ground party was marking with a stencil, using "Air Power Starts with Ground Power," toward a dock up to the front wheel of the Voodoo and after the pilot had been made, hauled the plane out of the hangar.

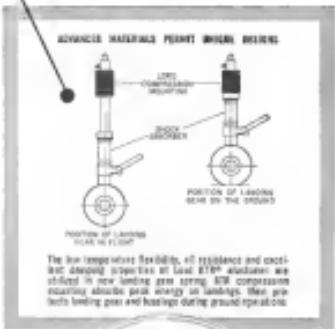


### Continental Develops 500-hp. Turboshaft Engine

Continental Aviation & Engineering Corp. is developing a 500-hp turboshaft engine, designated Model 217-5A, primarily for rotary wing applications (background at a show above). Engine weighs 210 lb. and runs at 6,000 rpm output shaft. Also under development is the Model 217-5A with 2,100 rpm (background, center, right) in set for next April.



## critical points for vibration/shock/noise control



### FIELD ENGINEERING OFFICES

ALASKA: ANCHORAGE, P.O. BOX 71000  
BOSTON: BOSTON, MASSACHUSETTS 02125  
CHICAGO: CHICAGO, ILLINOIS 60611  
DALLAS: DALLAS, TEXAS 75201  
DETROIT: DETROIT, MICHIGAN 48201  
FORT WORTH: FORT WORTH, TEXAS 76101  
HAWAII: HONOLULU, HAWAII 96813  
HONOLULU: HONOLULU, HAWAII 96813  
LOS ANGELES: LOS ANGELES, CALIFORNIA 90001  
NEW YORK: NEW YORK, NEW YORK 10016  
PENSACOLA: PENSACOLA, FLORIDA 32501  
PHILADELPHIA: PHILADELPHIA, PENNSYLVANIA 19101  
SAN FRANCISCO: SAN FRANCISCO, CALIFORNIA 94101  
SEATTLE: SEATTLE, WASHINGTON 98101  
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LORD MANUFACTURING COMPANY • FORT, PA.

**LORD**

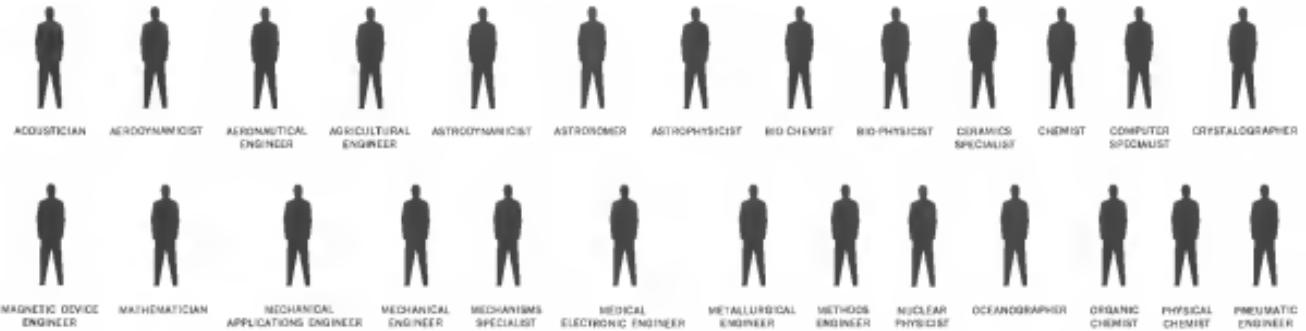
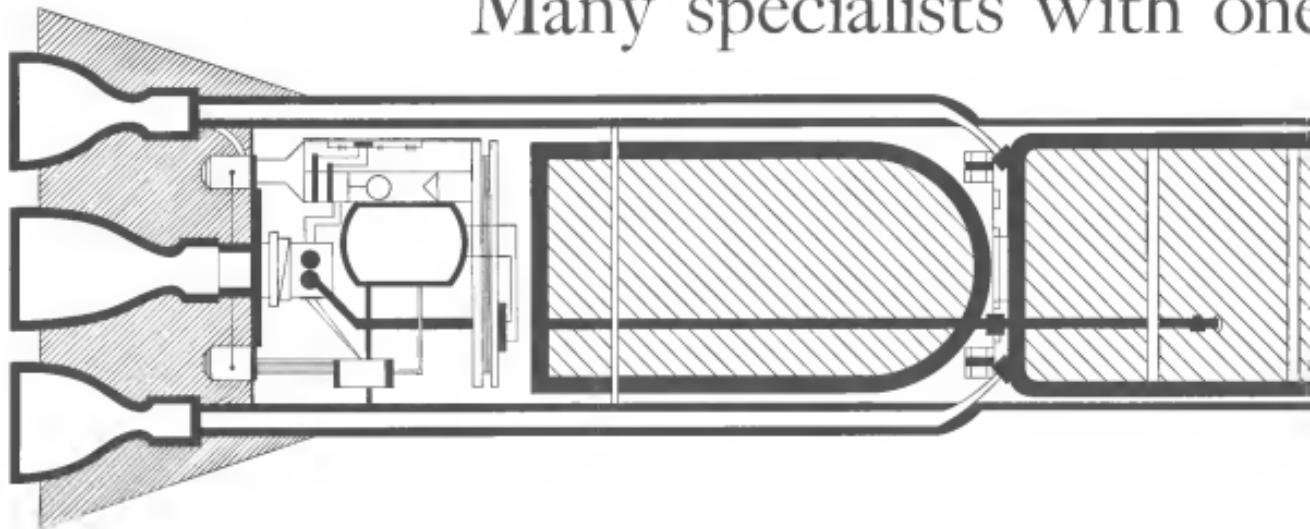
# Meet the specialists of space.....

Never in history have the talents of so many scientific and technical specialists been combined in order to achieve a single definable goal: exploration of space. Proof is provided by Honeywell. For at Honeywell alone, analysis shows that scientists and engineers assigned to space projects represent almost every division of the physical and chemical sciences. To demonstrate the range of skills required in the design, launching, propulsion and guidance of space vehicles, Honeywell's Specialists of Space—from astrodynamists to sociologists and theoretical physicists—are catalogued on the inside pages.

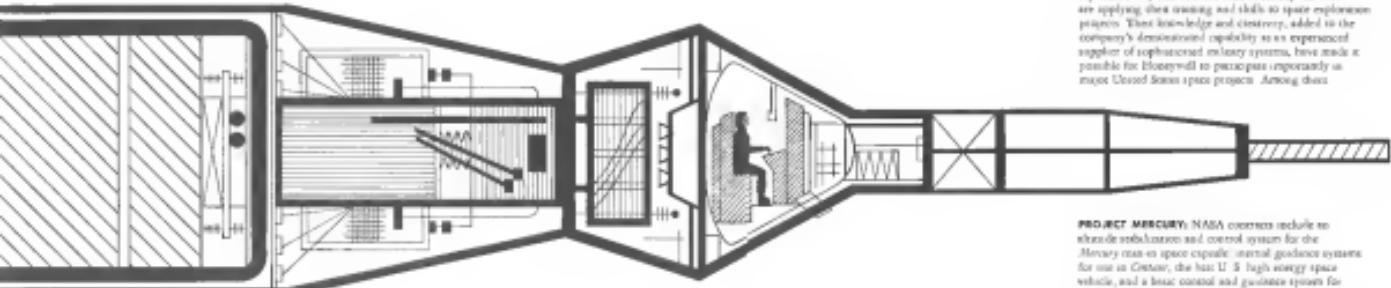
**Honeywell**  
H Military Products Group



# Many specialists with one



# The goal: supremacy in space



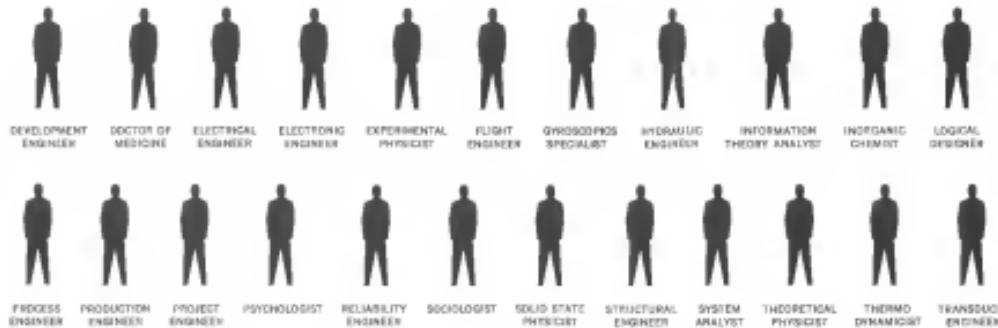
Illustrated on the diagram are the professional specialists represented by one or more men at Honeywell who are applying their training and skills to space exploration projects. Their knowledge and expertise, added to the company's demonstrated capability as an experienced supplier of sophisticated military systems, have made it possible for Honeywell to participate importantly in major United States space projects. Among these

**PROJECT MERCURY:** NASA contracts include the micro-manifestation and control system for the Mercury man-in-space capsule; inertial guidance systems for use in Gemini; the heat U-5 high energy space vehicle; and a basic control and guidance system for Skout, the basic booster vehicle for space research.

**SPACE CABIN SIMULATOR:** Honeywell has delivered to the Air Force's School of Aviation Medicine a device for simulating exactly the conditions under which two men would be required to function in space. Such tests extend as long as 30 days.

**DYNAMIC ANALYZER:** Work is in progress on a device that will test satellites and their components on earth under most of the conditions and phenomena encountered in space. The Dynamic Analyzer will be delivered to the Air Force's Wright Air Development Center.

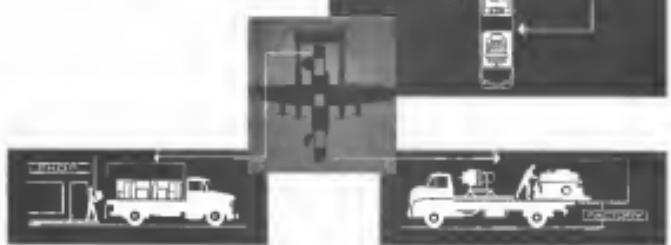
Honeywell capability is demonstrated here by work closely related to space exploration. Among these projects are ASROC, Thor, Atlas, Titan, Mariner, Pioneer, and a number of others that involve application of advanced technological concepts. If you would like further information about Honeywell's competence in helping to solve space-age problems, write to Honeywell, Military Products Group, Minneapolis 4, Minnesota. In Canada, write Honeywell Controls Limited, Wardlewood Ave., Etobicoke, Toronto 17, Ontario.



**Honeywell**  
 *Military Products Group*



# DOOR TO DOOR FREIGHTING WITH THE Argosy



## The revolutionary Rolamat-Argosy system of unitized loading

One pilot, one weight—one operational operation down to earth. This is the revolutionary air freight system with the Rolamat-Argosy system.

Small parcels are built up on the pallets, the enclosed load rolled onto a truck and straight from the truck into the Argosy. Parcels can be linked together to take heavy loads safely, such as machinery. No packaging is needed. Loads up to 150 tons, less than 8 ft. 8 in. high and 8 ft. 4 in. wide, can be rolled easily into the Argosy's 47 ft. long freighthold.

Designed to bring the cost of air freight down to earth

**HAWKER SIDDELEY AVIATION**

50 Dale Street, St. James's, London, S.W.1

A complete turnaround at the airport takes only 20 minutes, including refueling.

Off-loading is just as easy. The cargo is rolled onto the trolley, backed up to both ends of the fuselage.

We special handling techniques are required—lifting trucks and cranes can thus be completely dispensed with.

Rolamat saves time, saves trouble, saves money, saves labor, saves warehouse space. Yet all things really move with the Rolamat-Argosy system of unitized freight handling!

investment and turned it to position for the next customer.

Now a fleet of cameras in the RF-101C includes a group of four mounted forward in the specially built nose section and two mounted in a long fuselage compartment. The first used four.

• **Nose cameras**, shooting forward and slightly downward from the horizontal. Camera is a Fairchild Camera & Instrument Corp. KM-12 with a 32 in. F/2.8 lens and a minimum exposure time of 1/600 sec. The magazine is built by Coated Electro.

• **Vertical cameras**, mounted to shoot directly downward. Also built by Coated Electro, it is a KA-2 type with a 6 in. F/2.8 lens, with a minimum exposure time of 1/100 sec. Magazine is made by Chicago Seal Industries.

• **Two oblique cameras**, both type KA-2 with a 6 in. F/2.8 lenses and minimum exposure time of 1/100 sec. Magazine is made by Fairchild.

### Photo Coverage

Both the oblique cameras combined with the vertical give horizon to horizon coverage when the plane is flying straight and level.

• **Concentric cameras** in the belly are positioned to photograph large freight areas from high altitude, either the concentrating or converging cameras in low-level runs. The two belly cameras are Fairchild KA-1 type, with 16 in. F/2.8 lenses, and a minimum exposure time of 1/700 sec. Working together, they cover a 30 deg. field-of-view angle and provide the total 60% overlap between adjacent lenses to furnish eleven pairs of prints for photo-interpretation.

All the cameras are equipped with automatic control gear which can be preset for the type of lens and filters and which have a built-in gear free to switch off the other gears, so has to do in the cockpit. But if a control and functions or, for some reason, the control system have the previous day.

### Viewfinder Details

The installation includes a viewfinder for the pilot, which gives him a direct visual presentation of the cockpit floor when a gangplank is smoothly mounted. The viewer has four fields of view, ranging at 10 deg. and at 60 deg. downward, mounted from the vertical with an included angle of view of 30 deg., a 10 deg. field-of-view at 35 deg. included angle, extending from 5 deg. up to 80 deg. forward measured from the vertical.

Feeding into the motion is an automatic exposure control system which works like the shuttered type of photo-electric exposure meter except that it is much more sensitive and much more accu-

rate. This unit has to be able to change its own settings in flight to accommodate different lighting conditions, and therefore uses a double-beam system to measure reflected light in two areas. As the plane flies over a target area, any difference in the light intensity reflected by both "eyes" is detected and amplified to change the camera settings as the light changes.

Final sophistication in a modern photo-interpretation system is the target discrimination system.

During low-level, high-speed warps or turns or cloudy days, the exposure time may have to be increased, but the system is large and correctly designed. There are two ways of discriminating this: one is the camera, or even the film.

Both big vertical cameras in the V-101's fuselage are angled together and "panned"—moved with the direction of flight of the airplane—to obtain motion of the target.

But the smaller narrow-line an-



### Testing Harness Checks Out F-105D Circuits

Republic Aviation engineers can check out 3,000 electrical circuits on the F-105D using the specially developed testing harness. Prefabricated bridge-type fuses feature a history of in-service circuit and component failure rate less than 170 per 100,000 hours.

## THEY RELY ON RADIATION

for missile range  
instrumentation

In 1958, the Air Force called for a missile system to intercept the Atlantic Missile Range. The requirements: long-range, accurate, launching of missiles in 5 days.

It soon met the challenge with what was then a bold new concept in range instrumentation. The heart of the interceptive air system was a solid-state microwave tracking system made of all solid-state microwave tracking system. The system's job was to keep the missile within tracking range. Solid-state microwave tracking system has been to date.

Reliably assessing air force requirements, these scientists have a solid-state microwave tracking system made from Vycor, Porous, Deltarite, and Teflon.

Two of the systems were delivered to the Pacific Missile Range to meet an accelerated launching schedule.

**RADIATION** is a leader in space electronics. The Company has engineered developed and produced complete systems and subsystems for systems for NASA, AFPA, USAF, the Air Force, Army and Navy. Solid-state design was built into the systems of the National Hemispherical Observatory, the McDonald Observatory, the University of Texas, and the University of Michigan. The Vycor, Teflon, and Deltarite products are the result of a continuing research and development program.

If you'd like more information about solid-state solid-state equipment, contact: **Antennas Electronics Incorporated**, Dept. RW-4, Marksville, Florida.

Antennas Electronics Incorporated  
Marksville, Florida  
Phone: Marksville 3-3100  
Alt. Colquitt, Georgia

 **RADIATION**  
CORPORATION



1962, there were no cancer notifications during any of the Rascal Thalidomide trials.

The first test aircraft was also monitored by the physicians, which never showed a tumor. The only trouble experienced by the Wing was that the base and passenger cabin installed and the tubes were crimping inside the base. This meant that a Voodoo made two landings and then went to land the aircraft. At the end of the exercise, when some power issues were planned to check out equipment, the Wing canceled the mission and grounded the planes until new tubes were fitted in.

## Solid Lubricants Have High Load Capacities

General Electric will produce a series of new solid lubricants that are said to have 25 times the load-bearing capacity of pure molybdenum disulfide. Improved load-bearing capacity is obtained by adding approximately 10% by weight of various inorganic sulfides to molybdenum disulfide and tungsten disulfide lubricants. Most effective sulfides investigated to date are the sulfides of carbon, lead, mercury, platinum, silver and titanium.

## Fire-Fighting Truck Uses Turbojet Engine

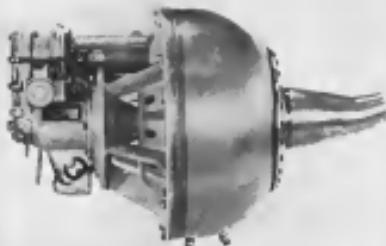
London-Neville's fire-fighting truck demonstrated at National Gas Turbine Establishment, Peacock, England on May 26 uses a gas turbine to generate static gas which rotates the fire water. Turbojet is fitted with a heat exchanger, and water is circulated via the exhaust nozzle augmenting the supply of water gas.

Gas turbine is a standard British-Sabine Viper turbojet mounted on a fire truck truck. Turbine has an air mass flow of 25.2 lb/sec and water at the rate of 14 lb/sec is fed into the jet pipe. The air enters turbo-compressor pump applied from the engine compressor.

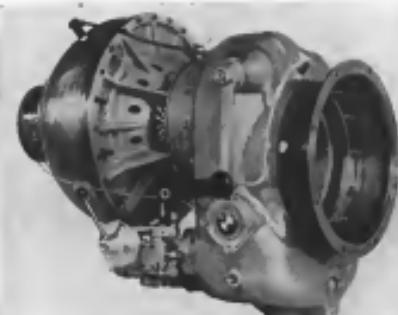
Compressing volume flow to the fire hose is 50,000 cu ft/min of fire gas at 1200 psi containing less than 5% by volume of oxygen. Output temperature of the effluent is governed by the need to deliver the gas through flexible piping.

Test gas supplies of this order, according to the British Fire Research Station, Borehamwood, would prove a much more efficient fire-fighting system than water in case of very large fires which, although subsequent, account for the great proportion of total fire damage.

The turbine would also reduce water damage.



GERMAN BMW 6003 takeoff thrust aircraft 79 lb. but can be used to 51 lb.



BMW 6003 gas turbine has been reported to 65 hp. at 45,000 rpm. under full load.

## BMW Jet Develops 79 lb. Thrust

**HOUSTON, TEXAS**—New BMW 6003 small gas turbine developed by BMW Flugmotoren GmbH, Munich, Alach, is based on the company's BMW 6002 portable gas turbine power plant introduced last year.

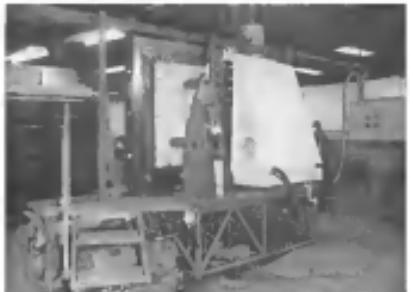
The 8025 km cu of weight of 77 lb. takeoff thrust is approximately 7% less than any engine to have emerged from the aircraft industry, will be increased to about 91 lb.

The engine is fitted with an electric starter and operates on any standard fuel, but for economy and safety the

use of light fuel or diesel oil is recommended. Fuel oil is used for lubrication. Prototype of the BMW 6003 was shown for the first time at the Houston air show.

Rating of the BMW 6003 gas turbine has been increased from 65 hp. to 65 hp. at 45,000 rpm under full load. Output shaft rpm of the 6003 can be reduced from 11,000 to 2,000 rpm by gearing.

The engine can be started with a hand crank or electric motor. Overall length is 36 in., diameter is 27 in.



Stainless steel panel is held in an upright envelope in a shield position, left, after being heat treated at 6,800° F between electronically controlled banks of radiant quartz lamps at Northrop Corp.'s North Division, Hawthorne, Calif. At right, the honeycomb panel is in its heating envelope in the heat-treatment station on Northrop's Hawthorne worksite.

## Northrop Automates Brazing of Steel Honeycomb



Stacks of packed quartz lamps (left) can be energized and controlled selectively for heating various panel shapes and sizes. Steady-state remote (center) is produced and temperature control center in Northrop system. Programmers (right) set a lower temperature plot to provide automatic temperature control. USAF awarded Northrop a \$946,447 contract to adapt process to manufacture of advanced aircraft and space vehicles. Process may eventually replace present 3 to 12 hr. furnace heating methods.



Nanobase has been applied to titanium alloy and is adaptable to metals in the columbium and molybdenum groups. Northrop will

## PRODUCTION BRIEFING

Plante Division of Tico, Inc., has begun operation in a recently completed facility manufacturing the isolated and fused-bond "Mason Modular Chair" designed for heraus, private and commercial areas. Features include hinged chair, swivelable electronic shopping cartstools and other industrial and recreational products will be integrated into a product line in the Plante Division.

Solar energy converters for the National Aeronautics and Space Administration's forthcoming lunar probe will use third greater efficiency than those used in present space probes will be furnished by Holstec Electronics Corp.'s Spacepower Division under a \$446,000 contract with NASA's Institute of Technology, Inc., Pasadena, Calif. Cessna's Cessna 172 aircraft will be used for 12 flights, mounting a total of 18,000 ultra-thin solar cells with a 10% energy conversion rate will have a power output of 95 watts.

Cessna Division of Underwood Corp. has received \$1 million in aerospace instrumentation and component contracts during the first four months of its current fiscal year. This compares with a \$1.5 million total volume for the same P.Y. 1969. Current contracts, including aircraft development and fabrication for Pacific Marine, the Air Force, Republic Aviation, Rockwell, Lockheed and the Navy cover ground instrumentation, airborne, aerospace components, distance measuring equipment, data link and data processing systems, training equipment, aircraft instrumentation and other safety systems.

A thermostatic switch, located in the engine exhaust system and providing for automatic ignition in the event of engine shutdown, engine flameout, is available in engine controls. Smith Instruments Inc. of Ardsley, N.Y., exhaust temperatures within a range of 12,000° F. to 400°F. out of temperature drops and drops below about 400° F. the switch automatically closes, cutting an ignition. Automatic sequencing of the circuit is provided once ignition has been accomplished. Smith provides the same robust capability in continuous ignition but eliminates the expense and potential problems associated with the latter, according to ARResearch Mfg. Division, of Cessna Corp., which produces

U. S. Sensor Corp., Los Angeles, will automate jet aircraft control systems for the General Dynamics F-111 aircraft under a \$10,000 contract. The photo-controlled domain permit mapping will be used for jet operation.

"COLD  
REMEDY"



AIR FORCE RECRUITERS PUT CESSNA U-3A SUPPORT PROGRAM TO THE TEST. This week at a small midwestern university town, two Air Force recruiters paid a visit to the campus and the local library, from morning to night, to recruit. The photo shows Cessna's Cessna 172 aircraft, the aircraft used for the Cessna U-3A, parked in a field. The aircraft is a single-engine, high-wing monoplane with a fixed tricycle landing gear. It is painted in a light color and has 'U.S.A.' markings on the side. The text 'COLD REMEDY' is overlaid in the upper left corner of the image.



## FIREPROOF

...with *Skydrol*-resistant cover



Characteristics: Flexoflex®-T tube, ATB, Type 364 stainless steel wire braid, specially impregnated asbestos fabric, with a flexible outer jacket and elastomer cover. Sizings: Dado 4 through -242 with integral type or Seal-Lock fire-tight fittings.

dest. 310 **RESISTOFLEX** Corporation,  
Westwood, N.J.

# NEW FEEDBACK CONTROL makes every weld count



Information from electrodes is fed back to **Monautronic** V-2 in background. Control has fully automatic sequencing with all processes for single spot, roll spot and seam welding.



Now, with the new **Monautronic** V-2 welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode slope and tip force, material thickness and surface finish... and compensates for these immediately.

The **Monautronic** V-2 automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage... and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic** V-2 embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

## CONVENTIONAL .250 SPACING



## MONAUTRONIC .230 SPACING

The **Monautronic** V-2 overcomes shadowing effects by using a computer-controlled voltage and current control, regardless of how closely spaced the welds may be. Photo micrographs compare clearly spaced welds made with conventional control with those made with **Monautronic** V-2. Notice how shadowing of voltage has weakened the center weld made with conventional control, while **Monautronic** V-2 has kept all welds uniform.

**ELECTRONIC**  
**Budd**  
CONTROLS

2400 Horning Park Ave.  
Philadelphia 32, Pa.

12141 Cheshire Ave.  
East 34th St., Los Angeles 23, Calif.

## SPACE TECHNOLOGY

### Reflectors Cut Solar Power Unit Weight

**Passives**—Combining a lightweight solar concentrator and photovoltaic cells, a space power supply system which develops the same voltage at 0.7 the weight of a conventional solar panel has been developed by Electro-Optical Systems Inc.

The strengthened system uses visible production silicon cells and the EOS-developed concentrator. Since a flat panel is more space-consuming than a faceted lens, concentrators other than the lead-lined boron carbide should be available for the first flight unit, which is planned for June 1963. Systems are being developed under contract from Wright Air Development Division. Although EOS still needs much design and engineering on its own,

EOS design approach accepts the inherent reduced efficiency of individual solar cells when they work at higher temperatures but obtains a higher total power output using the reflector than a panel of the same size without reflector could produce. Thus, while individual cells are working less efficiently, the reflector gathers more power from the higher illumination level, yielding a system which is more efficient in terms of watts per square inches of panel area.

#### Cell Efficiency

For its prototype system, EOS will use silicon cells which are about 12% efficient at room temperature but drop to less than 9% at the 110°F temperature level where the photovoltaic-concentrator operates. During initial development, EOS expects more efficient silicon cells will become available. Although several concentrator designs are being evaluated, the higher level of illumination from the reflector over panel surface in normal concentrations, EOS is developing its first prototype featuring flat plate reflectors in concentrators which are fabricated of aluminum foil covered on light frames. These can be folded for launch and spring outward to the desired position once the vehicle has reached space, and will be used in early flight systems.

#### Heat Rejection Problem

While simple and reliable solar cell space power systems have an inherent heat rejection problem, the concentrator system, which is a passive system which raises illumination level at the increases heating about the normal solar constant of 1.400w./sq. cm. which applies at earth orbit distance from the sun. For prototype and early systems,

EOS will use lighter emissivity coatings on insulating surfaces at the apogee to heat rejection.

A second approach will have spectrally selective filter coatings and/or solar cells to reflect as much as possible of the infrared and ultraviolet radiation species which contribute nothing to power output but increase heat rejection. Filters are designed for 100% rejection ratio, that is, when atmospheric attenuation significantly changes solar cell characteristics.

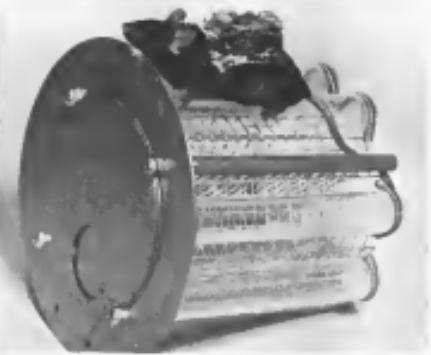
Another solar cell problem is high energy particle radiation environment in the Van Allen belt, which can put an unpowered solar panel out of commission in a week or less. Particle damage from this radiation is alteration or destruction of the crystal lattice structure of solar cells, cutting off electron flow and power output. Radiation also causes a degree of spotting on the cells. A

50 mil thick glass plate will be used in early flight systems to protection against this radiation.

First refinements in the flight system will involve different concentrator shapes, after which better filters will be sought, finally, better materials for the cells should be developed.

Although flat plate reflector-concentrators cannot yet concentrate a flat panel, they do obtain a significant increase in system performance in combination with EOS design techniques, such as a partial cone shape. However, the key elements in concentrators are to get maximum reflectivity, minimize light scattering, and obtain high efficiency, and high weight.

EOS reflectors consist of a reflective coating, a skin, and the skin support. The company has developed a proprietary fabrication technique for these, already using a few with thick me-



#### Radio-Equipped Mouse Atop Space Cage

Space rat cage to be installed in space-based models was designed and built at USAF School of Technical Medicine, Brooks AFB, Tex. After the capsule, which can sustain about one year in space, has set off, it has one of the subjects and its test carrying a short battery supply power. Wings of the capsule are apparently these first and it sends the mouse electrical potential from the antenna back to the satellite's reflecting system. During space, cage restricts the subjects' movement and prevents any due to floating during flight off. Cage also contains oxygen breathing equipment, carbon dioxide and water absorption units and a food supply.

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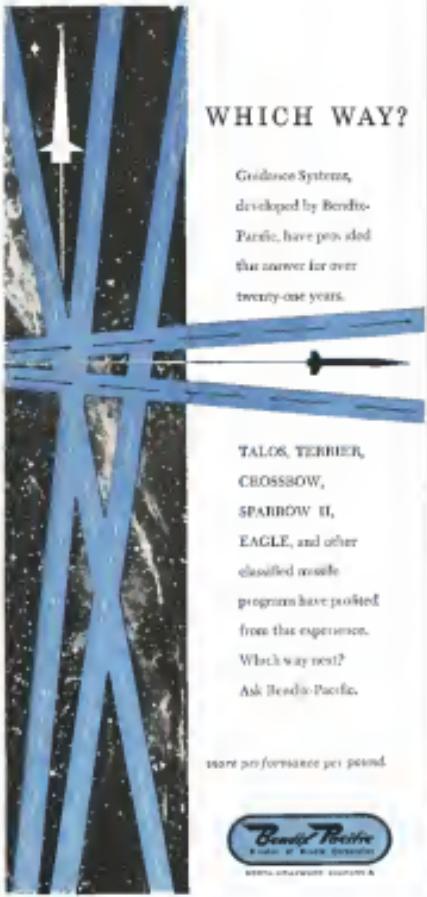
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formed to the required shape, after which the supporting structural material is attached or applied.

Skin are made of aluminum, beryllium and nickel, and spinning, stretch forming, electro forming and auto forming are used. Supporting materials include plates which are bonded into place and laminates. Critical weight is a strong shape of the skin while supporting is being attached.

High reflectance coating is vacuum deposited on surfaces.

A natural characteristic of solar cells is a decrease in efficiency with increase in temperature. In measuring new cell materials IBM looks closely at the slope of the curve representing efficiency decrease. Congress also believes that efficiency at elevated temperature is a very important criteria when space tubes are used, rather than performance at room temperature.

Two cell materials being developed are gallium arsenide and indium gallium arsenide. Production cells of these materials are available now which operate at 16 to 18% efficiency. IBM has also taken both these materials which work at 15% efficiency, and the slope of the performance curve shows them to become superior to silicon at temperatures above about 175°C. It is expected to be about 15 years before this quality is obtainable in production cells.

## World Astronautics Academy Planned

International Academy of Astronautics will be formed in 1969 as part of the International Astronautical Federation and will be financed for the first three years by the David and Florence Gor-gon Foundation.

The residence will be set up to advise the president of the International Astronautical Federation when requested to hold regional meetings and make scientific studies and reports, to publish an international technical publication on astronautics and to award medals and grants to further astronautic progress.

The French government has agreed to provide quarters for the academy in Paris at no charge. The academy is expected to be formed in August at the Stockholm meeting of the International Astronautical Federation.

## Goodrich-High Voltage To Build Ion Engine

Goodrich-High Voltage Astronautics, Inc., Lexington, Mass., will develop and fabricate a demonstration-type space propulsion engine utilizing an arc-type ion source. The ion thrust engine will be developed for Wright Air Development Division.

## Schlieren System Set for Mercury Tests

Hammond, Calif.—Multiple slit, sharp-binning schlieren systems are being developed now to demonstrate to McDonnell's interest. One schlieren system will have a 100-mm. objective lens, while another will have a 25-mm. objective lens, and a 100-mm. eyepiece lens.

An advantage of a multiple slit schlieren system is that it can be used in a transverse test section having prefocused cells for boundary layer blood screening in Northrop Corp.'s Nortronics Division. McDonnell's facility has a velocity range from the transverse region to Mach 1, and the boundary layer blood walls of the operating transonic section are only 0.05-mm. thick steel with 0.05-mm. diameter holes, giving the walls 25% porosity.

In addition to the observation control in the boundary layer blood walls, the outer walls of the test section have 10-mm. width surface supports for an 18-mm. x 13-mm. window pane. Nortronics' schlieren system can be shifted for complete coverage of the window area over a 13-mm. x 51-mm. range.

Schlieren can be both the upper-surface and perforated wall, or both the transverse and sharp-binning areas. The transverse region can have four slits spaced from the center of the test section span. The field of view at the transonic section is 15 mm. in diameter and is free of vignetting or fall-off in illumination at the edges of the photographs.

Working schlieren range is between 70 mm. of air and 2 deg. of angular deflection with a high sensitivity limit of 6 mm. of air.

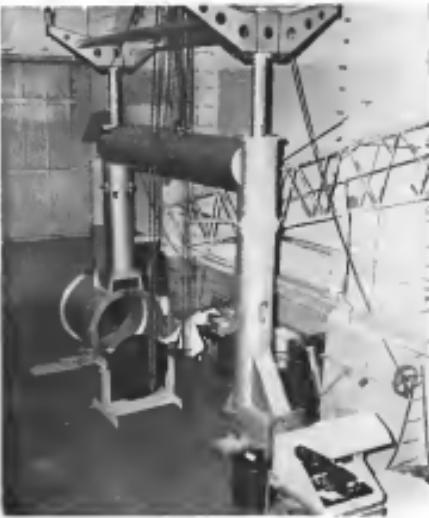
Because of problems encountered in obtaining the right focusing for the images made at the site selected by McDonnell, only the 7,000-lb. schlieren system is suspended from the tunnel overhead crane rails and is isolated from building vibration by integral coil springs.

The transverse direction is necessary to ascertain optical alignment of the light source and camera assembly. Movable on the overhead crane rails, this permits the camera to be moved in alignment with the tunnel facilities.

Operational requirements call for Nortronics for the McDonnell tunnel as follows:

• Sett 1000 to 10000. Focusing can be accomplished in one second. During a 30-sec. to 120-sec. duration test, cameras can be shifted and independently activated smoothly from the one test room control.

• Resolution of the optics is an alternative test section can be done within the 10-mm. interval between test zone while the blowdown tanks are unchanged. During this time interval, the





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water flows for monitoring and film washing over the entire orbital test section span can be accomplished plus refilling of the system to an alternate section, as well as complete translation sheet to either section plus adjustment and removal of the test section.

A continuous electron-beam television camera is incorporated for continuous monitoring during the tests, switchable with recording by either of the two cameras. The larger 70-mm camera has an exposure rate of five to 10 frames per second while the 16-mm exposure rate is from 10 to 100 frames per second. Light source is a xenon flash tube striking light with modified housing. One flash frame is provided while either of the cameras is photographing and 20 flashes per second are provided for the TV camera section. A gamma event interrupt the 16 per second flash at each frame as exposed by the Heitkötter camera. While photographing with the Farnsworth 16 per second camera or the 70-mm camera, the 16 per second frame is recorded.

The nose cone plate is 42 in. in diameter with 380 parallel holes, .041 in. wide and spaced .041 in. apart. Lenses and spacing are sensitive to either film or mirror .091 in. The nose cone plate will be made in Northeastern by applying a pattern sensitive coating tape in a flat sheet, glass plate and cutting the tape with a specially adapted hot iron or flame. Abutment glass plates are removed and a 1-in.-thick glass plate later applied to form a tank.

## Space Lab Would Orbit, Return Scientists

Dallas, Tex.—Manned space laboratory capable of supporting three scientists and 971 lbs. of test payload, developed on a cost-share basis by participating members of the aerospace community for maximum after-space missions. In house costs have been minimized by a pair of engineers of Chance-Vought Aircraft's Astronautics Division, Inc., engineers Robert H. Lomberg and James R. Dolan, believe that their concept could be placed into orbit within six years.

Concept provides for a space laboratory and separate return vehicle, the former residing in an 800-in. orbit, while the latter is used as personnel transport to earth. Both would be launched into orbit by a Saturn booster.

### Five-Year Schedule

Detailed funding available for the system by Lomberg and Dolan as the basis of best knowledge, obtainable, on-shore dry consumption for such a space gross total cost: \$3.1 million of that would, thus, be a quarter of the expenditure would be of a one-every year nature. Using the development on a five-year schedule, thus, an investment fixed year funding normally would be \$784.7 million. But they believe the program materials will cause substantial space programming.

The total program requires a modification of existing reentry vehicle and space station designated Starfish. The upper and lower fan-shaped light-weight structures on the un-enclosed vehicle would support solar cells to provide 3.5 kws of electrical power for the Starfish.

Lomberg and Dolan base the reentry's 500 mi. orbit on the fact that this would represent a low space craft orbit while also avoiding major exposure to the hazardous radiation in the Van Allen radiation belt. Starfish is designed to support three men for 14 days. In effect, the two would live

and 20 flashes per second are provided for the TV camera section. A gamma event interrupt the 16 per second flash at each frame as exposed by the Heitkötter camera. While photographing with the Farnsworth 16 per second camera or the 70-mm camera, the 16 per second frame is recorded.

The control panel is designed for operation with only one television switch with either camera. The strake firing logic automatically is included to provide the proper rate. A fraction of a second of diminished latencies of different colors is required.

Calibration for elevation versus direction is by use of a standard camera retaping wedge prism, required to make this the only adjustment system to calibrate.

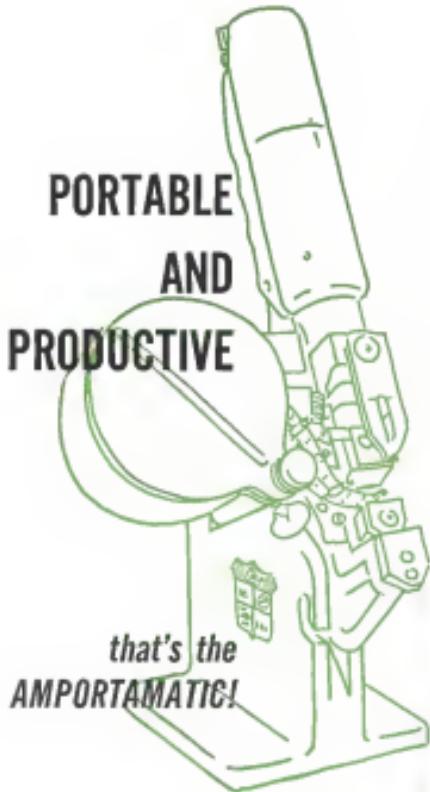
tank and return vehicle. A second complete module would cost \$27 mil. for including boosters and launch up.

• \$235,000,000, the largest unit item in the program would be expended on an engineering effort. All testing would amount to \$2,177,700,000.

• \$49,300,000 would have to be expended on research and development \$18 million on crew training, \$5.5 million on range and range modification, \$1.2 million for training and \$12.1 million each to be spent for space and equipment.

**THREE-MAN SPACE STATION** proposed by Chance-Vought Astronautics Division can expand its 100 mi. orbit section mounting solar cells to provide electrical power for the un-enclosed vehicle. Concept shows would support men to live with





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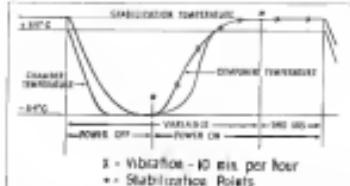


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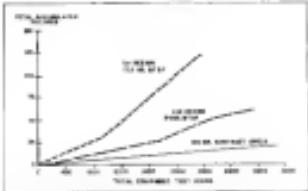
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## AVIONICS



TEST CYCLE for AGREE reliability test includes three-hour-plus temperature stabilization time at elevated temperature with power on, followed by a similar period at cold temperatures. Equipment is subjected to 10 ms. vibration every hour during tests. Shown at right are AGREE reliability test results on an ARN-12C Test set. In the first complete reliability test in design with rigorous tests, two reliability tests required to reach the TSB's intermediate-between-failure (MTRF) after producing 1,000 hrs.



## USAF Expands Use of Reliability Tests

By Philip J. Klass

Dayton—Air Force is rapidly expanding its use of the "get tough" reliability tests, developed several years ago by the Defense Department's Advanced Group on Reliability of Electronic Equipment (AGREE).

The Advanced Systems Center here, which pioneered the application of AGREE tests to avionic equipment procurement, soon let the program was included in nearly 40 contracts in being or under negotiation according to Col. Edward McKenna, chief of ASC's Communications and Reconnaissance Division. Except for bombing range countermeasure, this division had used of USAMR's software reliability approach.

Tests on the new Holloman Electronic System (ARN-12C) for the Strategic Air Command, which has the AGREE reliability specification, has demonstrated a "margin of safety" (MOS) in failure tests which is far less than the figure for earlier ARN-12C equipment.

### Careful Monitoring

First of the ARN-12Cs to be installed in operating squadrons will be monitored under a carefully controlled test program to determine the equipment's actual MTRF, or field use in order to correlate that figure with the MTRF as calculated from the AGREE test. The tests data on the specific types of failures that occur in the field to determine whether they are the same as those found in factory AGREE tests.

Preference indications as to the AGREE tests are much more severe than actual field use and that the ARN-12Cs should operate for several times

the mean time-between-failure figure expressed in the factory tests. Under the terms of the original ARN-12C contract, which Holloman has since revised to reflect an MTRF of 150 hr when subjected to AGREE tests, the earlier model ARN-12B sets calculated an MTRF of only 17 hr, when subjected to the same tests.

With this equipment, redesign and several years of reliability improvements effort, Holloman has been able to boost the mean-time-between-failures of the ARN-12C to around 75 hr. Air Force agreed to name the 150 hr figure for the first 1,000 experiments (or more) on this the lower figure represents a 100% improvement in reliability.

In order to obtain this greatly improved figure for this latest ARN-12C, Holloman has a 75% probability of operating throughout the entire test duration, whereas a set with a 5% MTRF has a 50% probability of operating for the full duration.

Logically, however, are the gains expected in maintenance costs. A set put with a MTRF of only 17 hr will cost a government 15 times as much to repair and keep in operating condition as one with a 75 hr MTRF, according to Col. James W. Williams.

Col. Williams, a Holloman Warrant Officer who currently heads production Air Force facilities on the details of the AGREE tests and writes them of their success, the consequences of failing to meet the tests can be costly in a combat environment.

In the original competition for the \$46 million ARN-12C contract which Holloman won, price was a major factor and Holloman quoted three quotes to the bone. When Holloman subsequently

had to take a waiver on the 150 hr MTRF in order to get Air Force to accept the set, the company had to accept a discounted revision to original contract price, McKenna says.

### Test Problems

Holloman's problem of getting the ARN-12C to pass the AGREE test has made more difficult by the fact that the set was not originally designed to meet these test and the type of corrective action which could be taken in conducting the equipment design was limited by the fact that the ARN-12C had to be interchangeable with earlier models of the field.

When experiments are designed from scratch with the AGREE reliability tests in mind, there is a less difficult problem. Using the Capt. Philip C. Schlesinger's reliability test laboratory at AFM, Edwards Air Force Base, Calif. He cites as an example the AN-12B and ARN-12C communications data links developed by Radio Corp. of America for use on the Convair F-102, McDonnell F-101B and Convair F-106. Holloman finds in data indicate those equipments will have no difficulty in passing the AGREE tests.

In a recent competition for a transistorized enforcement funding system, records which had to cover 1500 test items, several environmental test conditions, a program without previous experience, with each equipment submitted a quotation that was about 25% less than the original estimate, including a cost overrun to the company. An Air Force representative called to compare officials to be certain they understand the risks and responsibilities involved. When the company said it did, and that it was intentionally under-





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OPERATING ALTITUDE	0 to 10,000 ft (0 to 3,000 m)
OPERATING PRESSURE RATIO	1.0 to 1000 (100 to 1000)
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and operate at ambient temperature of 100°F, then cooled to -40°F. This level of performance is used for aerospace avionics equipment which can operate in extremely varied environments.

During pilot production runs on the ARBN 21C program, Hoffman was assigned to pick seven sets from initial production and subject them to a 50 hr power on operation with 10 mm of vibration each hour at a 193°F ambient temperature. Sets were then cooled to -40°F for about 1 hr, then returned to 193°F and the work repeated for 450 hr, and sufficient failures or damage were noted. During the above test, 16 sets failed due to vibration. It takes off and on for damage to occur. It takes off and on and started without attempting tests on other equipment.

During these initial tests a year ago, the stress suppressed operation, a total of 144 hours, giving an average mean time between failure of only 175 hr—a long way from the 130 hr MIL-STD required in the component contract.

Even, failure was severely reduced by Hoffman's ingenuity to eliminate the noise. Within the restrictions imposed by the requirement that the ARBN 21C be interchangeable with earlier models, the company set about eliminating noise-generating components. These included such things as installing a larger capacity cooling fan, reducing the power supply to five regulated rails, heavy coating, changing to six pin quality components and modifying certain circuits.

**Failure Cut**

Another seven sets of the modified design were then placed on test. After such had operated for 100 hr, Hoffman found that the number of failures had been cut in half, that is to say, to 90, but the average MIL-STD was only 91 hr, still far short of the goal.

Again, such failure was mathematically analyzed. The analysis showed for example that on the average, 100% of the failures were due to noise. Such failures were due to noise damage but the bulk of these were in a set noise causing fan motor had failed. Fixed failure failures were concentrated in the power supply module. Analysis of the circuits in this module showed that no noise was being generated beyond reasonable limits. Hoffman showed, however, that the conditions had greatly reduced the number of tube failures.

After another design modification and reliability improvement effort, Hoffman was pushed a MIL-STD of better than 75 hr this spring. At Fort Monmouth, he was told we were not to release these sets for field use until we had a reliability of 100% for 100 hours. However, Hoffman is required to demonstrate to push up the ARBN 21C mean time between failure with a figure of

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ARBN 21C Specs				
	Set 1 (standard)	Set 2 (reduced noise)	Set 3 (interchangeable)	Set 4 (interchangeable)
Dimensions	11x 10x 6 in. (280x 250x 150 mm)	12x 10x 6 in. (300x 250x 150 mm)	12x 10x 6 in. (300x 250x 150 mm)	12x 10x 6 in. (300x 250x 150 mm)
Length (in.)	1.20	2.00	1.10	2.00
Width (in.)	1.00	1.00	1.00	1.00
Depth (in.)	0.50	0.50	0.50	0.50
Overall weight	1.1	—	—	—
Wall clevis	4	—	—	—
Mounting holes	—	10/32 1/4-20	—	—
These are 100% standard design from available mean time between failure.				

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CHANCE VOUGHT AERONAUTICS DIVISION, DALLAS, TEXAS



150 hr being the goal after conversion has reached 1,000 ppm

Nancy Brown of Wausau has not yet applied the AGREE test procedure to any software, although equipment procurement, a spokesman said, but it may do so in a forthcoming project aimed at the new automated AN

A spokesman for the Boston office endorsed the proposal, and probably would have put the AGW b. 10 in the earlier if it were not as unequal for funds. He adds that the Boston office closely monitors the field units of the AGW b. 10.

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22115

► **Satellite Satellites**—In-house development programs to demonstrate the feasibility of low-area and low-physical-density sensor systems which can be carried below a point-shaped balloon carried below a point-shaped balloon de-coupled to gather radiobiological data in the stratosphere and the troposphere at part of the proposed CERST (Global Environmental Sampling Testbed). Satellites in getting under way at Yale University, Princeton, and the University of Arizona. These three experiments will be superseded by balloons and sensors part of an expected to constitute a balloon to test itself that will hopefully be destroyed if struck by a plane. Arising gas will be contained in 6-m square plane MAST-metres (Minimum Aerostatic Straining) each of which contain one or more complete suspended fine stratos. Metres will then be pasted onto a 5-H long, 18-38-m wide, Mylar strap, 50 of which may be stacked back to back, to form a "gull" which is culminated before launch. Gas can be exhausted during ascent through an expulsive valve. MAST-metres will have complex systems including transmitter, control, and sensors. All pointed toward a silicon solar cells composed of fine and weighing about one pound. Balloons are to be used for those to be mounted.

► **Antarctic Peeks Supplies**—None in this category are winning awards from North American Antarctic. This will be supply companies for fuel, provisions and scientific programs (AP, Dec. 9, p. 89), instead of existing clubs/level 1 or higher. **100** Contests. **100** million awards in level 1. **100** million awards in level 2. **100** million awards in level 3. **100** million awards in level 4. **100** million awards in level 5. **100** million awards in level 6. **100** million awards in level 7. **100** million awards in level 8. **100** million awards in level 9. **100** million awards in level 10. **100** million awards in level 11. **100** million awards in level 12. **100** million awards in level 13. **100** million awards in level 14. **100** million awards in level 15. **100** million awards in level 16. **100** million awards in level 17. **100** million awards in level 18. **100** million awards in level 19. **100** million awards in level 20. **100** million awards in level 21. **100** million awards in level 22. **100** million awards in level 23. **100** million awards in level 24. **100** million awards in level 25. **100** million awards in level 26. **100** million awards in level 27. **100** million awards in level 28. **100** million awards in level 29. **100** million awards in level 30. **100** million awards in level 31. **100** million awards in level 32. **100** million awards in level 33. **100** million awards in level 34. **100** million awards in level 35. **100** million awards in level 36. **100** million awards in level 37. **100** million awards in level 38. **100** million awards in level 39. **100** million awards in level 40. **100** million awards in level 41. **100** million awards in level 42. **100** million awards in level 43. **100** million awards in level 44. **100** million awards in level 45. **100** million awards in level 46. **100** million awards in level 47. **100** million awards in level 48. **100** million awards in level 49. **100** million awards in level 50. **100** million awards in level 51. **100** million awards in level 52. **100** million awards in level 53. **100** million awards in level 54. **100** million awards in level 55. **100** million awards in level 56. **100** million awards in level 57. **100** million awards in level 58. **100** million awards in level 59. **100** million awards in level 60. **100** million awards in level 61. **100** million awards in level 62. **100** million awards in level 63. **100** million awards in level 64. **100** million awards in level 65. **100** million awards in level 66. **100** million awards in level 67. **100** million awards in level 68. **100** million awards in level 69. **100** million awards in level 70. **100** million awards in level 71. **100** million awards in level 72. **100** million awards in level 73. **100** million awards in level 74. **100** million awards in level 75. **100** million awards in level 76. **100** million awards in level 77. **100** million awards in level 78. **100** million awards in level 79. **100** million awards in level 80. **100** million awards in level 81. **100** million awards in level 82. **100** million awards in level 83. **100** million awards in level 84. **100** million awards in level 85. **100** million awards in level 86. **100** million awards in level 87. **100** million awards in level 88. **100** million awards in level 89. **100** million awards in level 90. **100** million awards in level 91. **100** million awards in level 92. **100** million awards in level 93. **100** million awards in level 94. **100** million awards in level 95. **100** million awards in level 96. **100** million awards in level 97. **100** million awards in level 98. **100** million awards in level 99. **100** million awards in level 100.



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1. Developed a tube compound that can carry all aircraft fuels without showing appreciable signs of swelling or loss of adhesion to the carcass. A tube that withstands constant bending, twisting, and flexing without any separation. Performs well in the range -40°F to +130°F.
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more on *science* (especially *mathematics*) and the *application* of science, rather than *theoretical* science. High school students also learn about *science* as a *way of thinking*, using *systems*, *models*, *hypotheses*, *experiments*, *analysis*, *patterns*, *calculus*, *infinity*, *series*, *logic*, *geometry* and *algebra*.<sup>10</sup> In *higher education*, students learn *mathematics* and *science* in *university* courses.



## Ryan research finds new ways to get off the ground

Ryan is the pioneer and leader in vertical jet flight—the shortest and quickest way into the sky—with more than three million man-hours of research, design, and engineering experience with VTOF aircraft.

The world's first pure jet VTOL aircraft, the Roughton X-13 Vertijet, set a milestone in flight technology when it made its spectacular demonstration flights at Edwards AFB, and Washington, D.C. It was designed, developed, and built by Ryan four years ago for the United States Air Force.

Advanced knowledge has also been gained in the VTOL/STOL field with the Army VZERY aircraft, a turboprop-driven research plane which Ryan designed and now has under test for the Army and the Office of Naval Research. It employs the deflected airstream principle.

Now Ryan is underway on a new Air Force study contract for an even more advanced VTOL concept. It is the Veritail which provides, in a single propulsion system, thrust for both vertical and high-performance horizontal flight.

In the electronics field, Ryan is a recognized world leader in continuous wave doppler navigation systems. Ryan developed the first successful C-W doppler navigation—the most effective new method of aerial navigation for both high and low speed flight. Today Ryan navigation guides all types of aircraft, from helicopters and slow flying reconnaissance aircraft to high altitude supersonic jets.

Ryan's bold research plans in VTOL aircraft and navigation systems have biased a trend toward a new generation of military and commercial aircraft with increased capabilities.

RESEARCH AT AIAA has produced a unique, new "ultrapeeling" technique for making lightweight aluminum of very high strength. Ryan now uses this process, called Ryan Peeling, to load rocket chambers for the Navy's submarine-launched Polaris missile. Thin strips of steel are wound around a mandrel and electrically welded into solid form.

**RYAN BLASTS** rough, spiky, jagged shapes with high explosives. With a few shots worth of explosives, Ryan achieves forming patterns of over one million psi, to form rough shapes with precision, which could not be formed by any other methods. This has given Ryan a unique, new capability in creating difficult, delicate shapes.



For special tasks, advanced sensors for known, but untagged fuel facilities needed to build many types of radars and radars, or their components, are now being used at Lynn. Lynn's main responsibility comes from the fabrication of particle beam systems, the development of particle beam systems and particle beam systems based on continuous wave digital radars, and the design and production of over 1500 Firebox target missiles. - Lynn's most widely used jet targets,

Spain affords challenging  
opportunities to investors



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Ryan Aeronautical Company, San Diego, Calif.



## NEW MICROFILM PRINTER DOES WORK OF 25 MEN AT 1/2 THE COST!



TWENTY FIVE MEN plotting graphs at top speed could not keep up with Stromberg-Carlson's S-C 4000 High Speed Microfilm Printer. In a typical graph plotting application the S-C 4000 can plot a job better — at 1/2 the cost! And the S-C 4000 can save you money in dozens of other important applications. It will accept the output — on-line or off-line — of most major computers and produce accurate, high-quality

recording on microfilm at rates of 10,000 plotting points or alphanumeric characters per second.

The S-C 4000 may be used for plotting graphs, drawing curves, displaying programs, displaying maps, displaying data, Mathematical Manipulator used for design of mechanical components may be printed in drawings with significant dimensioning superimposed on the design. Ship's hull sections, aircraft wing sections and

other critical design components requiring descriptive geometry may be graphically displayed. With an optional automatic programming feature, graphical (table) data may be plotted in a matter of seconds only 8 seconds after film exposure.

LITERATURE AVAILABLE: Learn the complete story of the S-C 4000. Write to Dept. A-58, Stromberg-Carlson-San Diego, 2555 Hancock Street, San Diego, California.

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## NEW AVIONIC PRODUCTS

### Components & Devices

• **Surveillance Transistor.** Type 2N706A, an improved version of standard 2N706 silicon mesa transistor is available with guaranteed die heats ratings of 20 to



60. 25 nanosecond clarge storage, low contact, 5 m ohm parallel output reported. 40 nanosecond emission time for the basic 2N706 transistor is available in other designations. Texas Instruments Inc., P.O. Box 912, Dallas 75202.

• **D.C. Amplifier.** Model 100A, designed to convert low level d.c. input to +7.5 d.c. output. Features include continuously adjustable gain between 0.10 and 10, and 100 to 1000, 0.10, but straight line response gain within D.C. drift limit of  $\pm 0.5\%$  full scale of 250



volt. less than 5 kilohms output impedance, and 20 mV peak to peak current feedback for stable gain. For aerospace applications, such as military aircraft, the unit is available from Fokker Aircraft Corp., P.O. Box 6991, Dallas 75202.

• **Silicon power transistor.** H-2009 series with  $\mu_A$  of 1.200A and current ratings from 200 mils through 10 amps are available in hermetically sealed packages which will operate from -40°C to 150°C. Forward voltage drop does not exceed five volts. Intermet Electronics Corp., 19 Warren St., Mt. Vernon, N.Y.

• **Voltage regulator, designed for an input fluctuating between 6000**

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July 20 or portable style. Ranges which can be increased are: 5 mils to 5 mils; 500 pounds to 1,000 pounds; 1 mil thickness to 10,000 hours. Metrics line. Cleveland.

• Recording vibrometer, Models BS4-214 and BS4-216, track and beam writing, 40 mils amplitude two-channel portable recording in recording system with ultraharmonic ph-



• Transmitter, Model 09888, designed specifically for point-to-point ground-to-air communications. It operates from 2 to 12 miles in VSB 1500 baud rate independent sideband, variable 888 and 388 radioteletype and facsimile. Up to four cards removable 888 keys of type shown, each incorporating an air switch can be inserted into 33 in. x 7.5 in. x 30 in. transceiver cabinet. Wilcox Electric Co., Faureth & Chelten, Kansas City, Mo.

which employ 100% tin-copper and lead compositions, 45% to 50% tin-copper and 50% to 55% tin. Up to 1000°F. The 100% tin-copper is 100% tin. As the 100% tin-copper is 100% tin.

• Gears, Model Q2411 (heat treat 82113 treated gears), 2275-1000, nominal gears, designed to meet thermal shock, wear and dust test specs. In order and design conditions specified in MIL-G-5232, can be utilized. Gear weight 5.5 lb. maximum. Gear ratio 10.5 to 1.000 and units gear ratio of 1.000 and 1.920 per square inch of stock. Gear speed from 300 rpm to 100 rpm. Manufacturer: Gears Division of Coker Electronics Inc., 3 Little Rd., Highgate, Mass.

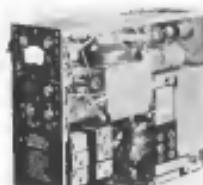
## Instruments

• Bridge, Model 544B, can measure deviations as small as 10.000 in. position indicators and repeaters. Bridge incorporates master scale with both high and low master settings and is suitable for go/no-go protection checks. The model is available in either



• Stripchart recorder, dual recording model of strip chart recorder model for panel installations is available. Both high and dual channels, each with range and chart correction and their own choice of accessibility can be obtained. Horizontal scales for both channels from 0 to 1000 are standard. Texas Instruments Inc., 1009 Buffalo Speedway, Houston 6, Tex.

## Radio Equipment



For military deep space probes or extended space flights it is frequently necessary to switch from an exhausted battery to a fresh one or to solar power. After launch, when the module is in flight, the power source is the battery, a solar panel is necessary to meet the survival requirement. The new Kinetics switch is easier to switch. It is more rugged and reliable than other designs and is important to shock and vibration characteristics.

## HOW TO CHANGE HORSES IN MID-STREAM!



## New Kinetics switch transfers battery power automatically in space craft



For military deep space probes or extended space flights it is frequently necessary to switch from an exhausted battery to a fresh one or to solar power. After launch, when the module is in flight, the power source is the battery, a solar panel is necessary to meet the survival requirement. The new Kinetics switch is easier to switch. It is more rugged and reliable than other designs and is important to shock and vibration characteristics.

For any switch application where switch reliability under tough environmental conditions is essential write or phone Kinetics Corporation, Dept. 520, 100 E. 22nd Ave., Denver, Colorado, Code 85450, 3-1311.

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## FORECAST

Laboratories for space sciences at Martin are now studying and forecasting the physical, psychological, and biological factors that will affect man in space... another tremendously fascinating program which attracts persons with exceptional professional abilities. If you have these abilities you are invited to communicate with N. M. Peiper, (Dept. CG-11) The Martin Company, P. O. Box 179, Denver 1, Colorado.

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## Titan G Fired Full Range



First SAC officer to set a test recorder on a Minuteman intercontinental ballistic missile long Capt. Albert B. White over site at missile. Shot was to serve as a Minuteman test for the infrared detection satellite measurement.



Area MR. IV test zone was cleared on the shot. The ready body, which has a trunnion flange section disassembled above black horizontal struts, is seen in configuration to the RVX-1 and 4 earlier shot was the fifth to go full range and make success in a new. Vehicle was one of the G series and will be followed by the J series operational prototypes.



Sikorsky S-55 approaches portside with hook studded by wooden boom. At right, pilot then boom was lifting chute.



## EQUIPMENT

### Altimeter System Corrects Pitot Error

By W. J. Shaw, S. Reed

Los Angeles, Calif.—Pilots of airframe-compensating system operating in conjunction with standard, uncorrected altimeters, has been developed to eliminate altimeter error due to pitot static pressure error.

Produced by the Garrett Corp.'s Avionics Manufacturing Division, the system corrects errors in the indicated altitude of transonic pressure caused by installation errors of static pressure sensors or by variations in measurement of static pressure from changes in Mach number, angle of attack, or air.

Essentially, the system solves, in rolling fashion, the relationship between indicated static pressure and free static pressure as determined in airspeed and altitude by calibration during flight test. It is designed for use in both military and commercial-type aircraft and eliminates the use of static pressure error correction cards when installed.

Indicated static pressure ( $P_{st}$ ) from the pitot static sensor is accepted by the pitot static converter which converts this value to free static pressure ( $P_{sf}$ ) by compensating for position, Mach, or angle of attack errors.

Resolving free static pressure output is an actual pressure output rather than as electrical representation of pressure.

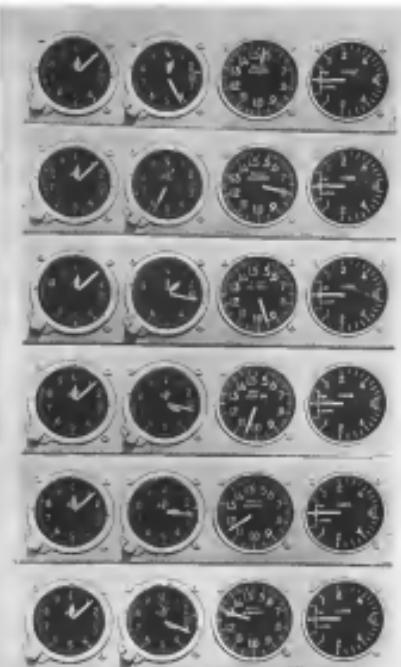
Inclusion of the static pressure compensation in the pitot static system provides corrected static pressure to be applied directly to the cockpit instruments.

#### How It Works

In operation, the static pressure compensation fraction is a force balance transducer. Forces applied to the balance beam are proportional to the indicated static pressure ( $P_{st}$ ) and free static pressure ( $P_{sf}$ ). The Mach transducer maintains the position of the balance beam for the force balance and thus insures the ratio of  $P_{st}$  to  $P_{sf}$  (the input) to  $P_{sf}$  (the output) is constant.

When a new balance position is selected, the beam will move to a new position at a given static pressure which either adds or subtracts pressure to the output ( $P_{sf}$ ) until the beam is in balance. Engine bleed air is used as the positive pressure source. Negative pressure source is obtained through the use of a jet pump.

Multiple validation of instruments in the pitot static system is permissible.



**CHARACTERISTICS** shown on test panel cockpit are those installed in a Convair 580 series aircraft. The Garrett Corp.'s Altimeter Manufacturing Division compensated controls out the errors which are usually caused by pitot static pressure errors. The panel shows the relationship between free static, indicated altitude errors (in feet) and indicated altitude (ft) and Mach number (feet/ft). In the first row, a 100 ft error is evident at a speed considerably below Mach 0.90. In the second row, the error is 450 ft at Mach 0.75, dropping to 1,100 ft at Mach 0.95. The error is greatest at Mach 1.05 due to Mach effects, but drops off at 1.15 and increases again at Mach 1.30. The Altimeter system is designed to be used in military and commercial aircraft and eliminates the need for static pressure error correction cards when installed.



Upon wagging procedure (note downward deflection of tail), cable is released from boom and chute is trailed to recovery area.



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and  
Shock-Resistant  
...precision

**Hermetically Sealed "HR" Switches**

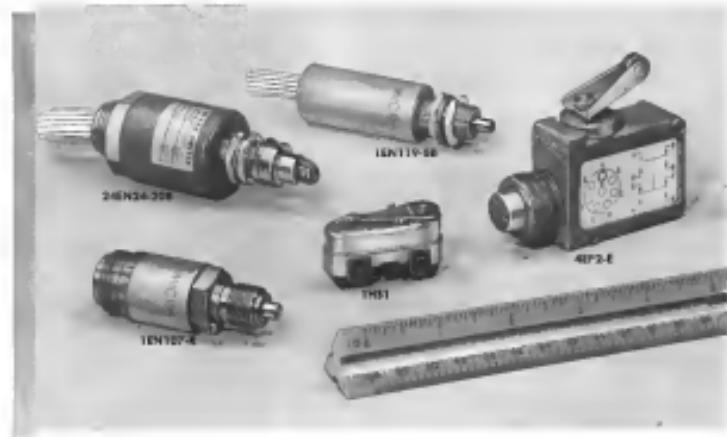
Explosion shock or high temperature from missile chamber presents no problem in Micro Switch HR switches. They are hermetically sealed to ensure accurate operating characteristics regardless of changes in atmospheric or environmental conditions. HR switches operate dependably in a temperature range of -65° to +600° F. All exposed parts are corrosion resistant. To qualify as a true hermetically sealed switch, the chamber containing the switching element is evacuated and filled with inert gas, the conductive sealing is glass-to-metal and metal-to-metal, and the contacted switching area is accessed through a sealed metal diaphragm. An insulating ring on the actuator shaft serves as a seal which might cause pinching or bending. Write for Catalog 77 which describes HR and other Micro Switch hermetic switches for aerospace equipment.



**12HBI-5 and 22HBI-5**—Both stainless steel single-pole double-throw switches operating over a temperature range from -65° to +600° F. Contact load 5 amp (resistive), 25 volt.

**22HBS-6**—High temperature limit with operating from -65° to +600° F. Contact load 5 amp (resistive), 25 volt.

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**10EN107-4** Motor BURNDY requirement, can withstand 1,000 pounds of sea water pressure per square inch. Has two high shock basic pointers. Write for Data Sheet 176.

**4DP2-E** Sturdy housing, exceeds shock and vibration resistance tests MIL-S-6745 and MIL-S-6744. Also meets immersion tests for MIL-E-5272A. Conduct hub houses

sealed solder terminals and diameter seal gland. Write for Catalog 77.

**10EN119-6B** and **24EN24-208** Both are used on missile test stands. Excessive proof tests with wire stripper may damage shaft to remove cap or seal which might cause pinching or bending. Write for Data Sheet 176.

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## GSE

Now in quantity production, Horkey-Moore-designed American Servicing Trusses will help AFSC's Hound Dog equipped B-52Gs guard the peace of the '80s. Designed to a new modular concept, powered by Wright Air Development Center and North American Aviation, GEMINI ground support equipment links AFSC's central air data system aboard the North American A-10 and the McDonnell F/A-18.

**STATIC PRESSURE** compensating system consists mainly of a pressure valve transducer and a static pressure compensator. A Research model is shown.

Because the compensator provides pressure-pulse pressure. Since the static pressure compensator prevents a load of only 1 cu in in the static line static pressure constant is still ensured.

The static pressure compensator unit is equipped with failure circuits which allows uncorrected static pressure to be fed into the system until the pressure of a failure. A bright warning light automatically is illuminated after a predetermined time delay if a failure occurs as the compensator should occur. At the same time, a spring loaded fail-safe valve switches the indicated static pressure directly to the right instrument.

The new system is similar to compensators already developed for Aerospace's central air data system aboard the North American A-10 and the McDonnell F/A-18.

### British to Gather Data On High Temperature Metals

**London**—National laboratory center for the collection and dissemination of data on creep and fatigue in high temperature metals is to be set up in the Department of Scientific and Industrial Research at the National Engineering Laboratory, East Kilbride, Eng. land.

All British metallurgical research or garners will submit to the center experimental data which will be reduced and presented in an agreed form to users and designers. A much needed attempt will also be made by the center to encourage British research work on these fields and to stimulate test procedures used.

The laboratory is part of an urgent DMR program to expand current fatigue and creep research programs, including the making now under way of a new creep testing laboratory in East Kilbride, where special techniques and equipment will be developed.



## WHAT'S NEW

### Publications Received:

**Propulsion Systems for Space Flight**—William B. Custer—McGraw-Hill Book Co., 330 W. 42nd Street, New York, N.Y. 10108, 352 pp. Sixth propulsion system as the rocket motor, two three-position valves and magnetic drivers are discussed. A detailed description of the ramjet propulsion concept for flight beyond the atmosphere.

**German Military Aircraft in World War II**—Burkhard Schlageter—Aero Publishers, Inc., 1000 3rd Avenue, New York, N.Y. 10021, 261 pp. This book contains 560 black and white drawings, 200 color drawings, descriptions, operational, performance data, engine and avionics data, history, production in Germany, and information on the experimental planes are given. One volume of the two is printed in Japanese and it is this volume that contains the photos and drawings, the other is an English translation.

The book—Charles A. Lindbergh and the American Dream—Doubleday & Co., New York, \$4.95. A biography of the life of Charles A. Lindbergh.

**British Civil Aircraft 1919-59** Vol. I—A. J. Lockett—Porter, 47 Great Russell St., London WC 1. Approximately \$6.82/65 (U.S. dollars). Reference work on all aircraft ever used for civil purposes under British ownership.

**Aerospace Research**—E. V. D. Glavin E. Reithm and J. Varga—Progressive Press Inc., 122 E. 15th Street, New York, N.Y. 10108, 364 pp. Reports presented by aerospace experts at the Aerospace Research Meeting held at Copenhagen, continued here. The focus is on detection and tracking of targets at high altitudes and extreme ranges.

**Representatives**—By David Lovins—McGraw-Hill Book Co., 330 W. 42nd Street, New York, N.Y. 10108, 138 pp. Summarizes the sources of data found in the test and design and outlines a tested ratings design for testing standard aircraft within bounds to meet overall system performance.

**Air Arms of the 1944-1953 War**—Bruce Robertson—Air Publications, Inc., 2125 Research Blvd., Los Angeles, 26, Calif. 90045, 221 pp. \$1.75. Compiled by eight armament history authorities at the major countries engaged in World War II. It contains biographies of the men of the U.S., Britain, Italy, Belgium, France, Germany, Russia, and Australia.

**Hiagos**. With 110 photos of these and the aircraft in which they fought. An appendix contains the arm's names, tables of fighter aircraft production data, destruction markings and a list of the arm's who served, their country's highest awards.

**Photomicrography of Metals**—Sibusi Suman, Division of Materials Research, Rutherford Lab., Princeton, N.J. 08543, 10 pp. Photomicrographs of metals, charts and graphs, covering the major sections on the micrography of aluminum, silicon in metallurgy, exposure determination, processing and plating.

**Man High-Alt. Col.** David G. Sensors (NACA USAF) with Don A. Schatzman—Doubleday and Co., Garden City, N.Y. 11540, 262 pp. An account of a balloon flight that was to carry the first human into the stratosphere of outer space, of the 72 hr spent there, and the final end zones of this experiment.

**Russian Aircraft**—Alan Gopstein Co. Ltd., Crows Nest, New South Wales, Australia, £1.50. English translation of a Soviet book, 1963, 224 pp., paperbound, £1.50 pp. This book by John W. R. Taylor contains photographs and data on Soviet aircraft including the records standing at the time the book closed, closed for press



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FOUR-PLACE 1961 Bellanca 260 sells for basic price of \$18,995. Optional equipment might raise price to \$24,995.

## Aviation Week Pilot Report:

### Bellanca 260 Flies Well at Varied Speeds

By Herbert J. Colenit

Teterboro, N.J.—Wide speed range, varying from a still at 45 mph. to a 200-plus high cruise, indicates a range of 6,800 ft.—that's over the 1960 Imperial Bellanca 260. Cruising speeds, a single engine, engine-driven propeller used and steel tubing.

Compete and set comfortable, the 1960 Model Bellanca aircraft has the 801 Imperial wing-wing except,当然, the Bellanca Cruisemaster first flew

in 1936, but has moved into a new fast-life covering, tricycle landing gear and elongated cabin. Gross weight is 2,790 lb., useful load is 1,018 lb.

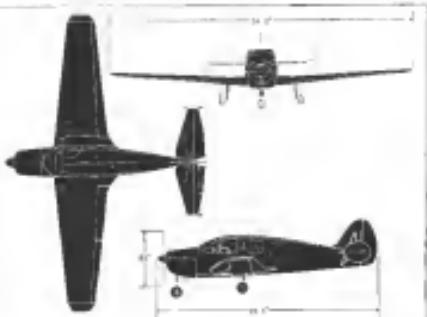
The Cruisemaster is produced at Alessandria, Italy. In U.S. it's known as the 1960 Imperial. Price, less a \$12 per month gear election schedule. Dousset Aircraft's 130-man work force has been increased in aircraft production to 200 management, which originally planned to build the Republic Seafarer under license.

The Alessandria firm is headed by J. P. Dousset, a former Sopwith, Italy, industrialist who founded the Scientific Bank Co. and entered the aviation field when he purchased a seaplane interest at Northern Aircraft, Inc., from Roy L. Strong, of Alessandria, who is no longer associated with the company. Robert Clugger is chief engineer and test pilot.

Acceptance of the Bellanca 260 in the business flying and executive market is indicated by its production rate increased recently from 10 to 12 a month. Dousset Aircraft sold 90 airplanes last year and newest indication is that one flight will be logged this month.

Dousset Aircraft follows what it calls "no planned obsolescence," i.e., changes in models are not done in for style purposes alone. (Compare) and this principle tends to "subsidize and encourage the 260," sales and price of these costs now on the market," keeping resale value high. The firm now has 16 distributors.

The Cruisemaster sells in a basic price of \$18,995, a cost that makes it competitive with the base price of the Beech Model 33 (\$19,995). Price 239



BELLANCA 260 aircraft at 4 deg. 10 min. bank angle is 0 deg. at least 5 deg. at tip



PAINT SHOP at plant at Alessandria (Milan) Airport is shown at left. At right, Bellanca 260 wing is covered with 21 fine-mesh stainless steel wire which is laminated to give best quality. After gluing and temporary tacking, wing is flipped to next task for sanding.

152,800) and Convair 270 (522,400).

Dousset does not attempt to match other production leaders or advertising and promotion budgets with these leaders, relying more on aggressive field sales tactics and word of mouth to sell the plane.

At field, the Cruisemaster cost to the owner with optional equipment installed—air, full gear panel and radio equipment, etc.—would range from \$21,700 to \$26,900.

Dousset Aircraft does no financing, leaves that phase of the operation to its distributor and dealers.

It is a source of particular pride to Dousset Aircraft that Federal Aviation Agency has cut him an Airworthiness Directive for the 260 requiring other leaders in airplane compliance. In month's a defect.

#### Continental Engine

The Cruisemaster is powered by a 260 hp Continental IO-470-F horizontally opposed, four-cylinder engine, located in the front of the aircraft. The engine is heat- and thermosiphon-cooled. Total air is 180/130 cubic. Major design changes include: \*Aliphatic fueling system, called "Pinto-Kote," which, the company says, has saved about 30 lb. in weight and provided considerably more strength and life than the previous silicone cloth burlap construction fabric.

\*Redesigned engine mount designed to reduce longitudinal stresses and vibration caused by high compression ratios and high gear settings.

\*Cylinder system has been changed from the left wing so as to reduce to a minimum the effect of the pilot's side, offering



CRUISEMASTER & 200 hp. Continental IO-470-F engine uses fuel injection. Non gear is reversible through master switch. Gear is hydraulically powered and cycles in 4 sec.

better air flow and control. Outlets with controls have been provided for both front and rear seat areas.

- Rear seat back has been made higher and 2 in. more head room, plus an inch or so shoulder room, has been added. Passengers also now have access from the rear cabin to the 186-cu.-cubic-foot luggage compartment behind the seat. Upholstery is upholstered in varying shades.
- Rear three-door Belfair design features has been retained and the customer now can choose from 10 different colors.

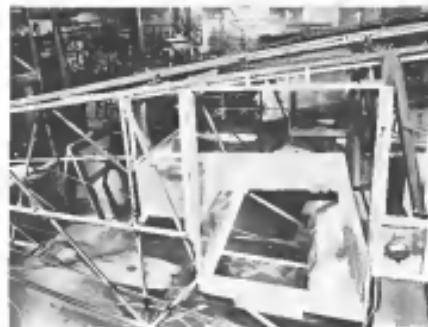
An interview with the American Wichita plant, accompanied by David Naucl, Domestic Aircraft's station director sales manager, showed the Cessna 310 to be an elegant, highly stable aircraft which is easy to fly and has good slow flight characteristics.

Plane flown at Teterboro Airport, N.J., was a new demonstrator with less than 100 hr. on the airframe and engine. On the ground, the 310 has a slightly nose-up attitude, caused primarily by a company decision to make the nose wheel the same size as the main gear for interchangeability and strength. Take visibility, however, is excellent.

Getting into the Belfair is a "hot" ticket for the customer. First, he



REAR SECTION of the Cessna 310 is assembled [above]. Below is luggage assembly, made of 4830 corrugated cardboard. Note auxiliary truck below luggage compartment.



**MOTOROLA Military Electronics Division**

## EVOLUTION & REVOLUTION

**REVOLUTION** in electronics may have its genesis in the evolution and synthesis of four prime areas: the rapidly maturing technologies of semiconductor development and production, surface passivation and stabilization research, electronic ceramics engineering and controlled thin film deposition. Synthesis of effort in many scientific and engineering disciplines is required to achieve breakthroughs in these areas and accelerate the evolution from conventional to microelectronic circuitry. The Solid State Electronics Department of Motorola's Military Electronics Division is exploiting this approach as the key to long life and reliable performance of electronic equipment by eliminating excessive complexity in component interconnection.

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## Specifications Bellanca 260

Gross weight	2,750 lb
Empty weight	1,600 lb
Useful load	1,040 lb
Wing span	54.2 ft
Length	22.11 ft
Height	9 ft
Wing area	181.5 sq ft
Wing loading (gross weight)	9.7 psf
Power loading (gross weight)	1.0 psf
Cruise speed	162.5 mph
Cruise altitude	10,000 ft
Range unassisted	12.08 hr
Range with	1.0 hr
Range unassisted	12.08 hr
Range with	1.0 hr
Takeoff	336 lb
Takeoff unassisted	49 gal
Takeoff with	39 gal
Takeoff	12 gal
Engines	Continental 1000 H.O. 70 HP, 260 hp at 1,615 rpm, with fuel injection.
Propellers	McCrory or Hartzell constant speed, 82 in. dia.

...on the right wing, grasping a handle held both the upper fuselage. By holding a circular handle at the door point of the modular design for added safety in case of a fire, the pilot always knows the value in the left seat. These are among the many new features started for even greater safety.

The flight panel is well designed for screen and visibility. Steering controls (steering lock, propeller control switch and selector) are clustered above the throttle and propeller pitch control. Radar controls are on the cockpit's side and flight instruments are in front of the pilot; the aircraft is fitted with dual controls and an inclined "W" wheel.

Smith was forced to both inspect and alter sections of the fuel piping and cracking the thoracic, static system is pushed and the propeller feed line going nosefirst into the ground.

### Gandy Day

It was a day, an excellent day for a flight exhibition. Barber made over 25 L.L. with gains in 10 and 35 L.L. and Telekone (lower score of individuals) to 7,000 ft. when, two-third down over targets, The 360, which has a 1000 ft. gain in under 1000 ft. pressure, was forced to land despite the strong winds and gusts.

At the intersection of Runway 24, we stopped for a longer runup of 25 ft. at maximum pressure and 2,500 rpm. Both magenta checked out (100 rpm drop is allowed) and we ran the propeller through before taking off 24 ft. for takeoff.

Takeoff was made at full power (25 ft. airspeed pressure and 2,500 rpm) and the engine was off the ground in about 10 ft. (An NACA demonstration team in a high performance aircraft, the Bellanca can get off in about 18 ft.)

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off, Neff dropped 15 deg. flap and used full power, holding broken-in when brakes were released. Neff headed back on the control column and the Bellanca set off the ground at about 150 ft at about 50 mph. We were 500 ft high at the end of the 1,000 ft run, climbing at nearly 2,000 fpm at 95 mph. There was no risk when flaps were used.

Next landing was made at a higher approach speed (about 110 mph) and higher final approach angle to cut the necessary entry pitch setoff open the runway smoothly and again the landing roll was quite short.

Optional equipment includes installation of a Michell automatic pitch-controlled unit-in, pitch and bank—with an automatic heading selection and altitude control costs \$3,120. Downey Aircraft also offers a search of communication and navigation equipment, plane flown by Avionics WES. For instance, was fitted with a Narco Mark II Orientation and 27-channel VHF transceiver and overhead speaker which costs \$1,595.

Another fact book (20 pg.) also is optional, at \$200 installed. Total fuel capacity with auxiliary tank at 56 gal gives a specified range of 913 mi. at



**BAKAGE COMPARTMENT** Has 165 lb capacity. Is accessible from passenger cabin.

44% power (10,000 ft, 18 in. manifold pressure and 2,600 rpm).

The Bellanca 260 is built in a plant at Mendenau Airport, although the aircraft design is centralized at a downtown location and travel to the plant. Wing is a monoplane structure made of skin space which is shipped to Downey Aircraft from Alaska. Dihedral is 4 deg. 10 min. and camber is 9 deg. at the root and 5 deg. at the tip.

Aluminum wood is used for tailstruts and control surfaces and are chosen for construction. Since 16 ft long tailstruts are necessary but between cabin installation, the gain is staggered to increase for increased strength. Not only that, the company says it is a pair of sawn wood struts which is about 40% stronger than the original piece of wood. Strips being laminated are kept under pressure for 24 hr; humidity is controlled to 70% dry. Front and rear spar weights are equalized. In order to provide fitting plates for the main landing gear on the six-pax cabinized fuselage is made by thickening blocks about 12 in. and 14 in. on each side.

The main wing is mounted with 2/3 in. orthograde phiosid which is fastened to gas head quality. After gluing and temperature baking, the wing is dipped in a resin bath for denaturing. There is no added drag from protruding wire bonds or drooped spot welds as with a metal wing.

Downey Aircraft says the new Phen-Kote finish covering has a high degree of strength, temperature, vibration, etc., in the environmental test and has no effect on the aircraft. Strength strength test is to drop 1,400 lb and fall onto the covering from 60 ft., to check safety.

The company says it has dropped the steel bell from 30 ft without puncturing the skin, which it used to have a high tear margin.

Engines are used in conjunction of the two-pot engine cooling for an otherwise flight engine. Cooling is secured with quick access hatches.

The 260 fuselage is made of welded 4130 normalized steel tubing, welded in a bridge-type structure.



Engineering design parts to name. An F-104 that never became USAF design, and one designed to cause USAF concern. Photos

**LOGISTICS PROBLEM—SOLVED BY CESSNA**

Problems to provide the Air Force's early, economical way to maintain its valuable fleet of Cessna U-3A light twin transports. Solution: a nationwide off-the-shelf support program built with Cessna's world-wide support of the U-3A's commercial counterpart, Model 310. In operation nearly three years now, the program has proved a success by every standard. Most important to the Air Force: shield time, trouble and dollars saved.

Low cost insurance supported by the insurance industry that the U-3A is extremely—and one way of the word is the best. Features strong, corrosion-free air with outstanding American's license in the me.

W. K. Karsner

**CESSNA**



**FAUVEL AV-36 CM** tailless glider exhibited at the recent Hanover air show was built under license by Aviotechnik Norden/Fried, Germany. It is based on the Fauvel Fauvel AV-36 glider prototype. The Fauvel Fauvel company now has a licensed version under development.

## Tailless Glider Has Engine for Takeoff

By Edith Walsted

Hanover, Germany—Single-seat Fauvel AV-36 CM tailless motor glider based on the French Fauvel AV-36 glider prototype, was among the Bellair/Fauvel/Fried, KG exhibit at the Hanover air show.

Several Fauvel AV-36 gliders were positioned and are flying in France and the French Fauvel company now has a research version under development.

The model at Hanover was built under license by Aviotechnik Norden/Goldf, Norden/Fried, Germany, a member of the Bellair group responsible

for Bellair's production program.

The glider is fitted with a 4.14-hp lightweight two-cylinder, two-stroke engine made in Kleinmotoren Goldf, Wiesbaden, Germany, which enables it to take off under its own power. Fauvel models had a single 11.4-kw Klimovastor powerplant and required either a pusher or trailing engine to become airborne.

The tailless Fauvel AV-36 CM has an

empty single-seat wing and derives its longitudinal stability from wing break and controlled location of the center of gravity. The aircraft is mounted like a biplane in the center section of the wing. The aileron control is conventional. The two rudder units are between elevator and rudder. The wing has a wingspan spar and physical control torsion box stiff. The section behind the spar is fibreglass-cored, the



**HUGHES 269A** Powered by 180-hp. Lycoming

Hughes 269A, civil version of Army YHO-3HU (AW Apr. 4, p. 88), is 22 ft 3 in. long, T-tail, 11 ft 6 in. high and has a landing width of 4 ft. 5 in. Empty gross weight is 3,570 lb., empty weight is 1,677 lb. Cruise speed is 95 mph. Operational range is 120 mi.

radar units are of similar construction.

The steel-tube fuselage is securely cradled with fabric or synthetic material, as shown. The wings are made from a single sheet of metal, folded into a flat rectangular shape. Both the pilot's and co-pilot's seats are adjustable. The single track steering gear has two wheels mounted as turbines under the fuselage. The rear wheel has brakes. The engine is mounted behind the rear seat in the center of the fuselage. It drives a multi-blade, 8.2 ft. diameter, automatically folding propeller, no nose drag when the engine is switched off. The engine is Maeve-cooled and rated at 14 hp at 3,000 rpm. Fuel container holds 4.75 gal.



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## PRIVATE LINES

Gormet Corp., Allentown, **Penn.** Sixty-five thousand, Los Angeles, Calif., Viking Aviation, Monroe, N. J., Standard Co.'s Cessna 170 with an in-line, in-tube, spread Minnesota-Moog nose landing gear, maximum gear box two-wheel mounted as turbines under the fuselage. The rear wheel has brakes.

The engine is mounted behind the rear seat in the center of the fuselage. It drives a multi-blade, 8.2 ft. diameter, automatically folding propeller, no nose drag when the engine is switched off. The engine is Maeve-cooled and rated at 14 hp at 3,000 rpm. Fuel container holds 4.75 gal.

Recent Bell Helicopter purchases include: Bell Aviation Services, which leased a de Havilland DHC-2 Ranger for general charter work in the San Francisco-Oakland, Calif., area. Bell Aviation will operate, from Bell Aviation Services. According to Bell, a company report on the firm, building docks in the privately owned Helico-Helicopter Inc., a newly formed service in Idaho, acquired a Mack II 47G-3 which it will initially use on charters to U.S. Forest Service. Aero Boeing Inc., Seattle, Wash., has added a Model 47G-3 to its fleet, totaling 15 Bells, which the company uses for timber cutting, seedling, geological work and survey services.

Hawkeright lightplane, the two-wing D-20. It was designed by a 116-kp. Walter Blower mounted engine has completed its flight tests. Single and two seat versions have been designed. Specs: front/rear, single-seat, 34.8 ft. length 26.3 ft., wing area 172 sq. ft. Gross weight is stated to be 1,380 lb. and empty weight is 1,241 lb. Maximum speed is given as 174 mph and range is 150 mi. Arguably, it looks like the Czech Z-226.

Increase of 38% in operating plant sales for the first half of Fiscal 1960 are reported by Cessna Aircraft Co. Sales of \$302,000,000 for the six months ending May 31 are compared with \$214,497,000 for the same period last year. Cessna sales by all divisions for the six-month period totalled \$563,314,000, a 7% increase over the same period in Fiscal 1959. Earnings after taxes were \$123,800, or \$1.10 per share.

Contract to do periodic overhaul of National Airlines' Pratt & Whitney JT-4 turboprop engines was recently awarded to the company by the carrier to Lockheed Aeronautical Co., Love Field, Dallas, Tex. Southwest Airlines also expects to get its first National JT-4 early this summer. It previously had contracted with Lockheed Aeronautical to handle its JT-4s.

Four delivered 125 passenger and 20,000-lb. airplanes in April, having a total list price, selling value of \$3,995,218. Delivered in April airplanes were: 38 PA-18s, 12 PA-18-4s, 36 PA-32 Tri-Pacers and Comanches, 46 PA-35 Av-

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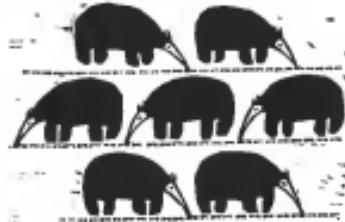
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### PROBLEMATICAL RECREATIONS 18



What is the remainder upon dividing  $3^{100,000}$  by 7?

... *Answer on page 103*

The Advanced Devices Laboratory of our Avionics Division concentrates its efforts on establishing new frontiers in the microwave field. It is removed from the day-to-day problems and responsibilities of production design and engineering.

ANSWER TO LAST WEEK'S PROBLEM: Colonial Downs-



LITTON INDUSTRIES  
Beverly Hills, California

### U. S. Business & Utility Aircraft Shipments

March 1969

Manufacturer or Model	No. of Units	Net Shipments
Aero Doctor 400	1	\$1,000,000
4000	1	
5000	1	
Beech 180	1	\$1,440,000
180A	1	
180B	1	
180C	1	
180D	1	
Beech 35	1	\$100,000
Beech 75	1	\$1,200,000
75A & 75B	1	
75C & 75D	1	
75E	1	
Bellanca 800 Trainer	1	\$100,000
800 Trainer	1	
800 Pilot	1	
Bellanca 800	1	\$100,000
Bellanca 8000	1	\$100,000
Beech 95	1	\$100,000
95A	1	
95B	1	
95C	1	
95D	1	
95E	1	
95F	1	
95G	1	
95H	1	
95I	1	
95J	1	
95K	1	
95L	1	
95M	1	
95N	1	
95O	1	
95P	1	
95Q	1	
95R	1	
95S	1	
95T	1	
95U	1	
95V	1	
95W	1	
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95Y	1	
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95AB	1	
95AC	1	
95AD	1	
95AE	1	
95AF	1	
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95AK	1	
95AL	1	
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95BA	1	
95CA	1	
95DA	1	
95EA	1	
95FA	1	
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95TA	1	
95ZA	1	
95AA	1	
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95BA	1	
95CA	1	
95DA	1	
95EA	1	
95FA	1	
95GA	1	
95HA	1	
95IA	1	
95JA	1	
95KA	1	
95LA	1	
95MA	1	
95NA	1	
95OA	1	
95PA	1	
95QA	1	
95RA	1	
95SA	1	
95TA	1	
95ZA	1	
95AA	1	
95AB	1	
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95AD	1	
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95AF	1	
95AG	1	
95AH	1	
95AI	1	
95AJ	1	
95AK	1	
95AL	1	
95AM	1	
95AN	1	
95AO	1	
95AP	1	
95AQ	1	
95AR	1	
95AS	1	
95AT	1	
95AU	1	
95AV	1	
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95AX	1	
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95AZ	1	
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95EA	1	
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#### STRUCTURAL ANALYSTS</h4



# LETTERS

## True Deterrence

In reading the letter by Mr. Roth (AW May 25, p. 124) it is not hard to see that it can indeed be useless sounding out the verbal slogan. We can be sure that because of the words used, the letter does not carry much thinking.

An analysis of Soviet strategy will show that they are willing to take devastating damage to their cities and bases, but if they can be assured of the survival of their people in every other location, namely Western Europe, they are of no use to the Soviet Union. Therefore, though no one might consider a very poor deterrent, the profession of basing our missile subs does not lead us to all pessimism. Since it is our national policy to act aggressively in a war, therefore we must be prepared to inflict maximum damage to a nuclear attack. Perhaps Mr. Roth does not expect to be the first blow by the Soviets, even with his meek view.

The true nature of a deterrent force is that force which causes the enemy to wish to do no more than to inflict the minimum conceivable amount of damage to its overall governmental entities and national interests. For this reason we do not need sufficient numbers to enable us to completely dominate the enemy's striking force. We need only sufficient numbers to be able to neutralize the enemy's striking force. We do not need, therefore, 1,000 missiles to pose any adequate deterrent.

We need not rely totally upon missiles, however, and we have many tools that are equally suited to the task of nuclear deterrence. (There are many other tools that do not work with all missiles.) The inability to recall a missile is perhaps the most notable tool. The surviving user with range is another. Missed missiles are, therefore, a necessity. We need only short range missiles to be able to recall the missiles were to be never located at the preferred much of the time.

In reality, then, it is not a question of how much we are spending on missiles, but rather how we are spending what we do have.

To put it another way, the cost per unit of a precision weapon is often

more than the cost per unit of a precision weapon.

Mr. Roth should be more specific.

Edgar A. USP, USAMRMC

Colorado Springs, Colo.

## Radiation Weapons

I read the brief report entitled "Anti-Ballistic Missiles" (AW May 25, p. 121) with considerable interest. To add a small note, we have placed some of our letter concerning space deterrence in the proceedings of our annual strategy (including this year's) When one considers that the U.S. spends approximately \$175 billion per year on the development of defense, it is not surprising that the Soviet Union's annual expenditure about \$45 billion, though we are not spending quite as much as they do.

As to the protection of our society, how can the military protect a people who apparently do not want to be protected? These have been actions enough to provide public financing for shelter. All have

planned

planning of their strategy and bodies should proceed consistently with the particular methods of weapon configuration. In particular, the nuclear ground-based missile defense system radiation forces must be detailed specifically. It can be argued that the use of ground-based radiation weapons will be only half-baked and that only by placing these weapons in a space environment can we create a truly effective defense against ground-based missiles.

If the Russians begin the first to operate mounted satellites (and everything is leading the Russians' pace of our own space program) points to the U.S. must make first those well-established criteria, accordingly to serve the purpose of the space-based missile defense system. Space will be an ideal environment for the use of radiation weapons, and it is not probable that the Russians will claim a portion of such post-space range with us. The Russians launching an anti-satellite weapon in the vicinity of a mounted satellite, another warning that we can now be forced from space.

Space weapons will be as vital as the next big decade as we are apparently in the past 20 years, and those who release space flight's "darkness" will be a wonderful era for the United States. We have the most terrible threat that of Hiroshima.

There is an element of this situation in discussing as the probability of a Russian maneuver of space flight—the last of four between the second and the satellite between the third and the fourth—and the impact with a space probe of this possibility was higher. From my own experience I can state that the probability of a radiation weapon is apparent in the summer of 1971. Furthermore, although I am not a rocket scientist, and I did not have much solid education available to scientists, I had developed a basic concept of a man-mission rocket by the fall of 1974. Yet as far as I can tell, no government body considered the possibility of a radiation weapon until the publication of a report in a scientific journal in the spring of 1979, the CLEPRA program (AW May 2, 1979, p. 15). Consider what data that must be lacking the less of two to three years seems remarkable.

It is difficult to conceive a danger in the possible manipulation of delayed defense that cause prolonged delay that defense must be enacted at once. We have no time to live.

Arthur M. Marston, Jr.  
New Bedford, Mass.

## Gulliver's Travels

Your photo story on a closed missile reentry vehicle (AW May 25, p. 103) brings to mind Delibes' "Gulliver's Travels" at the Academia of Legos in my voyage to Legoland, over the sea. There, here he got a terrible smell when his master went to bed, caused by the seafarer but that Dr. Chapman is now solving. I am not sure the Duran, now, is the same as the Delibes, attributed to his 19th century scientist.

Terence B. Farnham  
Pacific Palisades, Calif.



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